HAMILTON'S
ESSENTIALS OF
ARITHMETIC

MIDDLE
GRADES

Lealand Lealand
Morton
Morton Lealand
Morton
Lealand Lealand
Morton Morton
Lealand Lealand
Morton
Morton Lealand
Lealand Morton
Morton Lealand
Morton
Lealand Lealand
Morton Morton
Lealand Lealand
Morton Morton
Le and Laland
Morton Morton.

Lealand Morton

Lealand
Morton

You   Me

HAMILTON'S ESSENTIALS

OF ARITHMETIC

MIDDLE GRADES

BY

SAMUEL HAMILTON, Ph.D., LL.D.

Superintendent of Schools, Allegheny County, Pennsylvania

PREFACE

THIS series of "Essentials of Arithmetic" consists of three books, which cover the arithmetic work from the second to the eighth year.

The two important ends sought in the teaching of arithmetic are (1) to give the pupil such a mastery of number combinations and processes as will enable him to perform with accuracy and speed all common numerical operations; and (2) to train him in the skillful application of these processes to the problems that he is likely to meet in his daily experiences. This series has aimed to lay equal stress on both these important phases of arithmetic.

The frequent drills in numbers in their abstract relations develop habits of accuracy and speed. Efficiency is encouraged by advising the use of short methods, by frequent timing of the drill work, and by insisting on checks for accuracy.

The problems have been framed with a view to the pupil's interests. Beginning with data drawn from his immediate environment, they reach out gradually to include his contact with the larger spheres of social and industrial life. The problems are of two types, — first, isolated problems, which provide direct application of a principle to some need or experience of the pupil; and, second, groups of related problems, called "Everyday Use of Numbers," which center about an idea or a situation in which the pupil feels a vital interest. These related problems serve as a review of various principles previously taught. The problems are all *real* because they are true to life. They carefully avoid unpractical conditions and all questions that have no relation to

3

common experience. The business problems follow present business usage.

The pupil's self-activity is utilized in constructive work. His initiative is exercised by leading him to discover many arithmetical truths for himself. The importance of the correct interpretation of problems and of the choice of the best methods for their solution is emphasized. The " Problems Without Numbers " tend to develop the power of generalization.

This book for **Middle Grades** covers the work that is usually taught in the fifth and sixth years, each chapter representing one half year's work.

By the end of the sixth year, this book aims to give the pupils a knowledge of all the arithmetic principles that are essential for success in the ordinary affairs of life.

The effort to follow prevailing prices has been limited by their rapid fluctuations and by their variation in different parts of the country. Teachers should encourage pupils occasionally to substitute current local prices, thereby varying the problems in the book.

SAMUEL HAMILTON

CONTENTS

CHAPTER I

CHAPTER III

CHAPTER IV

CHAPTER I

REVIEW

READING AND WRITING NUMBERS

Numbers play an important part in all the activities of life, and you cannot hope for much success unless you learn to handle them with ease.

Before you study the many new and interesting things about numbers that will be found in this book, it will be well to make sure that you have not forgotten what you have already learned. First of all, you must be able to read and write numbers rapidly and accurately. In your games and occupations, in your purchases at stores, and in your accounts of your earnings and expenditures, you do not often use very large numbers; but as you see them frequently in newspapers and magazines, you must learn to understand their meaning and to read them readily.

You have learned that the common method of reading and writing numbers makes use of the following ten figures:

Zero	One	Two	Three	Four	Five	Six	Seven	Eight	Nine
0	1	2	3	4	5	6	7	8	9

1. Read the number on the blackboard.

2. In 376, for what does the 6 stand? the 7? the 3?
376 = 3 hundreds, 7 tens, 6 ones.

3. Read 3498. For what does each figure stand?

Each figure has a value that depends on its **place in the number**. The first place beginning at the right of a number is called **ones'** place; the second, **tens'** place; the third, **hundreds'** place; the fourth, **thousands'** place, etc.

4. Show that the left-hand 5 in the number 555 has a value, because of its place, that is 10 times the value of the middle 5, and 100 times the value of the right-hand 5.

A number containing more than four figures is often separated, for convenience in reading, into groups, or **periods**, of three figures each, beginning at the right. The name of the first period is **units**; of the second period, **thousands**; of the third period, **millions.**

The number on the blackboard above shows the arrangement of periods, and the three orders of figures in each.

Beginning at the right, mark off into periods, and read:

5. 2439	**8.** 758650	**11.** 405682	**14.** 1578563
6. 3750	**9.** 775570	**12.** 140560	**15.** 1556893
7. 4005	**10.** 205605	**13.** 685000	**16.** 1003704

Observe that *zeros* are enumerated but never read; that *and* is never read between integers; and that the *first period* is simply read but not named. Thus, 376 is read " three hundred seventy-six."

Write:
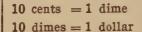
17. 10 thousand 4 hundred 6.
18. 150 thousand 5 hundred 25.
19. 5 million 825 thousand 5 hundred 4.
20. 5 million 25 thousand 3.
21. 2 million 22 thousand 60.
22. 6 million 27 thousand 9.
23. 5 million 5 thousand 5.
24. 8 million 8 thousand 85.
25. Ten thousand one hundred ten.
26. Five million two hundred fifty.
27. Six million six thousand six.
28. Sixty million one hundred fifteen thousand five.
29. Forty million four.
30. Ninety-nine million six hundred thousand nine.
31. Ninety-eight million one hundred fifty-four.

Read aloud. Then write the numbers from dictation:

32. There were 1,500,000 women in the United States engaged in war industries.

33. From 1907 to 1916 an average of 100,000,000 one-cent pieces was coined each year; in 1917 there were 213,500,000 one-cent pieces coined; and in 1918 there were 445,228,201 pieces coined.

34. The boy scouts of America sold $17,000,000 worth of War Savings Stamps. They distributed 13,350,420 pledge cards averaging over $11 a card. They were awarded 2741 medals, 6679 bronze palms, and 8225 buttons.

35. Here are some of the requirements of an army of 5,000,000 men: 17,600,000 blankets, 7,978,000 overcoat 83,000,000 pairs of shoes, 25,000,000 flannel shirts, 110,000,000 pairs of stockings, 7,000,000 campaign hats, 9,500,000 caps.

36. Write a problem containing numbers with nine figures.

UNITED STATES MONEY

| 10 cents = 1 dime |
| 10 dimes = 1 dollar |

1. The dollar sign is $; it is placed before the number of dollars. The sign for cent or cents is ¢; it is placed after the number of cents.

When dollars and parts of a dollar are written as one number, a period, called a **decimal point**, separates the dollars from the cents. Cents are written in the first two places at the right of the decimal point. Thus, 7 dollars and 45 cents is written $7.45.

NOTE. Always read the word *and* between dollars and cents.

Parts of a dollar may be written in three ways. Thus, 18 cents may be written 18¢, $0.18, or $.18.

One tenth of a cent is called a mill. Mills are not coined; but they are used in many calculations. $.003 is read "3 mills," $.025 is read "2 cents 5 mills," $.184 is read "18 cents 4 mills."

2. Read in as many ways as you can:

| 25¢ | $6.54 | 9¢ | 106¢ | $9 | $.75 |
| 200¢ | $.04 | $0.95 | $0.07 | $9.00 | $6.60 |

3. Read; then write from dictation, using the dollar sign:

$.03	$6.98	$5.035	$.804	$.008
$.033	$7.09	$2.005	$.90	$.60
$4.50	862 dollars and 5 cents		100 cents 5 mills
$0.85	10 dollars and 1 cent		689 cents 4 mills

In business, the seller usually regards any part of a cent as an additional cent.

Read; then write from dictation:

	a	b	c	d	e
4.	$5.09	$5.05	$3.00	$4.055	$ 12.09
5.	$6.00	$0.07	$ .02	$ .984	$ 20.08
6.	$8.47	$9.99	$1.05	$1.656	$254.45

ROMAN NUMBERS

Roman notation is used on many clock faces, as well as for chapter numbers in the Bible and other books, for inscriptions on monuments, etc.

1. Review the following Roman numbers:

Letters	I	II	III	IV	V	VI	VII	VIII	IX
Values	1	2	3	4	5	6	7	8	9

On clock faces 4 is often written IIII.

The letter **X** stands for **10**. Placing X before each of the Roman numbers in Ex. **1** makes the Roman numbers from eleven through nineteen. Thus, XI = 11, XIV = 14, XVI = 16, XIX = 19.

2. Read: XII, XIII, XI, XV, XVI, XVII, XIX, XVIII.

3. Write all the Roman numbers from 11 through 19.

4. Copy and memorize the following numbers:

Letters	XX	XXX	XL	L	LX	LXX	LXXX	XC
Values	20	30	40	50	60	70	80	90

Placing each of the Roman numbers in Ex. **4** before the Roman numbers in Ex. **1** will make all the Roman numbers from twenty-one through ninety-nine. Thus, XXIV = 24, LVI = 56, XCIX = 99.

5. Read: XXI, LXV, XLIV, LVIII, LIX, XXXVI, LXXIII, LXXXVII, XCII, LXIX, XLVIII.

6. Write in Roman numbers: 9, 45, 91, 24, 39, 56, 88, 74, 67, 18, 21, 36, 58, 99, 76, 85, 44.

7. Copy and memorize the following numbers:

Letters	C	CC	CCC	CD	D	DC	DCC	DCCC	CM	M
Values	100	200	300	400	500	600	700	800	900	1000

400 may also be written CCCC; 900 may also be written DCCCC.

Placing each of the Roman numbers in Ex. 7 before those in Ex. 1 and Ex. 4 will make all the Roman numbers from one hundred one through one thousand ninety-nine. Thus, DIX = 509, DL = 550, DLIX = 559.

8. Read: CXL, CCLX, CDV, CCCI, DCCL, DIX, CMLX, MX, MCIX, MDXX, MCMXXI.

9. Write in Roman numbers: 150, 365, 480, 752, 804, 965, 1922, 527, 213, 671, 1908, 1920.

10. Copy and memorize the following numbers:

$$\overline{V} = 5000 \qquad \overline{IX} = 9000 \qquad \overline{M} = 1,000,000$$

A bar placed over a number multiplies it by 1000.

11. Read: $\overline{VII}$, $\overline{II}$, $\overline{X}$, $\overline{XII}$, $\overline{IV}$.

Notice in the numbers IV, IX, XL, XC, and CM that when the letter of smaller value is placed first, the values of the letters are subtracted (IV = V − I = 4). Notice in the numbers VI, XI, LX, and DC that when the letter of larger value is placed first, the values of the letters are added (VI = V + I = 6). Notice also that repeating a letter repeats its value (II = I + I = 2, XXX = X + X + X = 30).

Write in Roman numbers:

12. 66, 33, 290, 540, 1453, 1492, 700, 59, 1100.

13. 1900, 1726, 1564, 4000, 20,000, 1616, 572.

ADDITION

The process of uniting two or more numbers to form one number is called **addition**.

The numbers added are called **addends**.

The sign **+**, called *plus*, indicates addition. The sign **=**, called *equal* or *equals*, indicates **equality**.

The result of addition is called the **sum** or **amount**.

Oral and Written Work

Answer rapidly:

1.	8	28	38	58	68
	9	9	9	9	9

7.	18	28	58	68	98
	7	7	7	7	7

2.	19	39	49	69	89
	6	6	6	6	6

8.	28	38	58	78	88
	6	6	6	6	6

3.	18	28	38	98	88
	8	8	8	8	8

9.	17	57	87	77	97
	9	9	9	9	9

4.	19	39	59	49	79
	5	5	5	5	5

10.	16	26	76	96	46
	7	7	7	7	7

5.	35	95	65	85	45
	6	6	6	6	6

11.	44	74	84	94	64
	9	9	9	9	9

6.	27	47	67	87	97
	7	7	7	7	7

12.	28	48	68	78	88
	5	5	5	5	5

To test addition, add in both directions.

Add, observing the groups that make 5, 10, 15, 20, etc.:

13.	14.	15.	16.	17.	18.	19.
4 } 10	7	8	7	8	3	2
6	8	3	4	9	9	6
7 } 10	4	7	6	3	8	4
3	7	6	5	5	2	8
5	8	4	7	4	7	4
9	1	2	2	6	8	6
8 } 10	0	1	6	7	5	5
2	9	7	5	9	4	7
5	3	5	4	8	2	8
7 } 20	8	6	5	9	1	1
8	9	4	6	6	3	9

Write from dictation; then add and test, observing groups:

20.	21.	22.	23.	24.
541	862	720	839	564
462 } 8	321	287 } 10	463	268
376	456 } 15	823	726 } 15	374
814 } 10	289	541 } 10	339	827 } 10
296	815	569	187	623

25.	26.	27.	28.	29.
325	4250	20,150	3984	52,306
237	629	107	4	20,006
63	47	360	296	30,750
104	2307	26,348	307	5,600
9	234	6,065	6875	170
937	276	205	4397	52,879
428	999	304	6123	30,562
632	708	591	4187	41,028

Add:

30.	31.	32.	33.	34.
35,701	575	5609	9401	8026
6,531	1039	41	672	643
320	9901	60	56	29
43	601	853	803	660
7,501	8010	731	10	3032
4,507	301	550	9083	8009

35.	36.	37.	38.
$80.00	$329.60	$200.65	$3245.07
1.05	300.06	30.00	4706.50
6.09	6.09	976.38	5079.06
87.63	709.36	40.79	5904.00

Numbers applied to the same kind of unit are called **like numbers**; as, 3 ft. and 5 ft., or 3 and 5; but not 3 ft. and 5 ¢.
Only like numbers can be added or subtracted.

Time yourself in adding these examples. Then try again and see whether you can beat your first record.

39.	40.	41.	42.
$25.36	$163.75	$243.15	$121.48
43.72	275.84	65.74	83.62
96.81	486.39	182.33	275.14
39.47	928.75	34.62	8.73
62.58	265.73	215.73	16.28

43.	44.	45.	46.
$3795.90	$4678.65	$9450.00	$6354.00
4784.00	875.60	845.76	280.01
5450.25	3490.00	46.01	4045.06
6350.00	348.45	749.98	98.00
7450.05	2246.79	3.87	.98
5365.00	1400.00	4021.23	12.12

SUBTRACTION

Subtraction may be defined in three ways: It is the process (*a*) of finding the difference between two numbers, (*b*) of taking one number from another, or (*c*) of finding what number must be added to a number to make a given number.

The number from which we subtract is called the **minuend**.

The number to be subtracted is called the **subtrahend**.

The result is the **difference**, or the **remainder**.

Note. In the definition given in (*c*) the number corresponding to the minuend is a sum and the other two numbers are addends.

The sign —, called *minus*, indicates *subtraction*

Oral Work

Business men **make change** by the addition method of subtraction. Thus, if a purchase is made for $ .69, and $ 1.00 is given in payment, the clerk will hand back a cent, a nickel, and a quarter, saying " 69, 70, 75, 1 dollar." The clerk makes change with the fewest pieces of money possible, handing out the smallest coins first.

Imagine that you are the clerk when the following purchases and payments are made, and count out the change to the customer in the above manner.

	Cost of Purchase	Amount Given		Cost of Purchase	Amount Given
1.	$1.85	$2.00	8.	$3.77	$5.00
2.	2.96	3.00	9.	2.86	4.00
3.	2.15	5.00	10.	5.09	6.00
4.	3.18	5.00	11.	.95	2.00
5.	1.14	1.50	12.	.74	2.00
6.	4.15	5.00	13.	6.05	10.00
7.	2.25	5.00	14.	7.15	8.00

Written Work

Subtract each number below from 1000, allowing 1 minute for each column :

1. 225	**5.** 216	**9.** 725	**13.** 715	**17.** 375
2. 314	**6.** 500	**10.** 946	**14.** 800	**18.** 814
3. 625	**7.** 499	**11.** 328	**15.** 125	**19.** 731
4. 374	**8.** 795	**12.** 613	**16.** 629	**20.** 656

21–40. Subtract each of the numbers in examples 1–20 from 10,000.

Subtract, timing your work. Then try again and see whether you can beat your record. Check results by adding.

41.	607,008 448,789	**44.**	180,260 98,775	**47.**	800,647 98,749
42.	756,008 398,497	**45.**	100,907 49,899	**48.**	870,009 698,058
43.	640,006 290,809	**46.**	230,900 97,897	**49.**	906,700 798,897

50. 36,005 − 19,096

51. 90,000 − 27,938

52. 23,000 − 17,500

53. $4629.70 − $3675.84

54. $1475.55 − $539.47

55. $3000.73 − $2036.75

56. $9143.65 − $6183.69

57. $24,000.47 − $6937.64

58. $2039.05 − $1729.89

59. $9400.37 − $2869.94

60. 630,209 − 189,768

61. 620,005 − 246,937

62. 610,034 − 263,805

63. $2473.87 − $629.75

64. $9000.45 − $4167.23

65. $6343.75 − $900.84

66. $9143.92 − $6287.75

67. $4816.75 − $2407.84

68. $94,367.48 − $21,697.83

69. $21,485.86 − $11,475.97

Keeping a Cash Account

Every pupil should form the habit of keeping an account in a small blank book.

1919		RECEIPTS					PAYMENTS		
Aug.	5	Cash on hand	3	50	Aug.	6	2 Handkerchiefs		50
	6	Errand		25		7	Car fare		10
	7	Gift	10	00		8	Red Cross	1	00
	9	Sold beets		25		9	Collar		30
						11	*Balance*	12	10
			14	00				14	00
Aug.	11	Balance	12	10					

The sum of the cash on hand and the receipts (left-hand side) is $14. The sum of the payments (right-hand side) is $1.90. The difference, $12.10, is written as *Balance* in the right-hand column below the last payment; and the column is then added, showing $14. As this amount is the same as the total of the receipts column, the account is correct. "Balance $12.10" is also written in the receipts column below the sum.

Make out and balance the following cash accounts:

1. Receipts: Feb. 4, cash on hand, $5.15; Feb. 5, shoveling snow, $.50; Feb. 6, tending furnace, $.25; Feb. 7, carrying bag, $.10; Feb. 8, chopping wood, $.15.

Payments: Feb. 5, repairing skates, $.50; Feb. 6, fountain pen, $2; Feb. 7, skating cap, $1.50; Feb. 8, muffler, $.75.

2. Receipts: July 1, cash on hand, $7.75; July 2, running errands, $.15; July 3, weeding garden, $.50.

Payments; July 1, fish line, $.50; July 3, bathing tights, $.55; July 5, ball, $.50; tennis racket, $5.

3. Receipts: Oct. 7, cash on hand, $4.25; Oct. 8, securing magazine subscriptions, $1; Oct. 9, making dresses for Helen's doll, $1.50; Oct. 11, weekly allowance, $.50.

Payments: Oct. 8, stationery, $.65; Oct. 9, car fare, $.10; Oct. 10, club dues, $1.

MULTIPLICATION

The process of taking one number as many times as there are units in another number is called **multiplication.**

The number multiplied is called the **multiplicand.**

The number by which we multiply is called the **multiplier.**

The result of multiplication is called the **product.**

The multiplicand and multiplier are called **factors of the product.**

The sign × indicates multiplication. It is read "times," when the multiplier *precedes* the sign. Thus, 3 × $5 is read "3 times 5 dollars."

A number used with reference to a particular object is called a **concrete number;** as, 5 days, 10 pounds, 8 inches.

A number used without reference to a particular object is called an **abstract number;** as, 5, 8, 20.

The multiplier is always regarded as an abstract number.

NOTE. The multiplicand may be either concrete or abstract. When it is concrete, the product has the same name as the multiplicand.

Compare the product of 8 × 6 with the product of 6 × 8; the product of 2 × 14 with the product of 14 × 2.

Either factor may be regarded as the multiplier.

How to multiply and divide by 10, 20, 100, etc.

1. Multiply 42 by 10. Annex a zero to the right of 42. Is there any difference in the products? Which of these two methods of multiplying is the *shorter?* Multiply 42 by 100. Annex two zeros to the right of 42.

2. Multiply each of the following numbers by 10; by 100:

43   26   75   96   283   694   786   813   465   710   634

Written Work

1. Multiply 323 by 325.

Multiplicand,	323	**323**
Multiplier,	325	325
1st partial product,	1615 = 5 × 323	1615
2d partial product,	6460 = 20 × 323	646
3d partial product,	96900 = 300 × 323	969
Entire product,	104975 = 325 × 323	104975

To test multiplication, use the multiplicand for a multiplier and perform the multiplication again; or, divide the product by the multiplier.

2. How much will 48 chairs cost at $1.25 each?

$$
\begin{array}{r}
\$\ 1.25 \\
48 \\
\hline
10\ 00 \\
50\ 0 \\
\hline
\$\ 60.00
\end{array}
$$

Multiply as before, and mark off from the right, in the product, two places for cents.

3. 45 × 63 bu. = ?

4. 29 × 87 ft. = ?

5. 46 × 215 doz. = ?

6. 78 × $326 = ?

7. 86 × $293 = ?

8. 91 × $145 = ?

9. 97 × 609 = ?

10. 85 × 987 = ?

11. 68 × 694 = ?

12. 65 × 45 = ?

13. 78 × 56 = ?

14. 42 × 89 = ?

15. 50 × 78 = ?

16. 45 × 38 = ?

17. 45 × 67 = ?

18. 48 × 67 = ?

19. 67 × 34 = ?

20. 47 × 200 = ?

21. 67 × 450 = ?

22. 54 × 709 = ?

23. 75 × 908 = ?

24. 56 × 109 = ?

25. 47 × $ 5.67 = ?

26. 78 × $ 3.50 = ?

27. 43 × $ 5.69 = ?

28. 75 × $ 8.97 = ?

29. 82 × $49.85 = ?

30. 98 × $67.80 = ?

31. 65 × $99.94 = ?

32. 76 × $87.87 = ?

33. 78 × $66.05 = ?

34. 46 × $68.07 = ?

35. 25 × $60.80 = ?

36.	850	37.	6754	38.	$60.70
	67		608		80 06
	5950		54032		364 20
	5100		40524		48560
	56950		4106432		$485964.20

Find products and test:

39. 809×3750 **49.** 678×8190 **59.** 500×6780

40. 370×2009 **50.** 547×7800 **60.** 450×6001

41. 400×3098 **51.** 101×8901 **61.** 780×6791

42. 209×6708 **52.** 560×9000 **62.** 560×6401

43. 609×8078 **53.** 798×9008 **63.** 101×1000

44. 458×6009 **54.** 567×7980 **64.** 109×2300

45. 650×8079 **55.** 440×7860 **65.** 708×8001

46. 407×7900 **56.** 450×7009 **66.** 650×5160

47. 608×8004 **57.** 579×6009 **67.** 765×7180

48. 440×7980 **58.** 478×4890 **68.** 832×9001

Multiply and test:

69. 6425		*a.* 247	Form 10 groups of 10 examples
70. 1024		*b.* 344	each by multiplying each multipli-
71. 8720		*c.* 564	cand by each of the multipliers,
72. 9652		*d.* 746	thus :
73. 8665		*e.* 804	
74. 7894	by	*f.* 961	69 *a.* $247 \times 6425 = ?$
75. 8465		*g.* 869	69 *b.* $344 \times 6425 = ?$
76. 7695		*h.* 796	76 *i.* $968 \times 7695 = ?$
77. 8425		*i.* 968	NOTE. The teacher may assign a
78. 9476		*j.* 898	different group to each of 10 class

teams and notice which team makes
the best record for speed and accuracy.

DIVISION

The process of finding how many times one number contains another, or of separating a number into equal parts, is called **division**.

Division may be defined also as the process of finding one of two factors when their product and the other factor are given.

The number to be divided is called the **dividend**.

The number by which we divide is called the **divisor**.

The result of division is called the **quotient**.

The part of the dividend remaining when the quotient is not exact is called the **remainder**.

The sign ÷ indicates division, and is read *divided by*.

Oral Work

1. Division is indicated in three ways: $15 \div 3$, $\frac{15}{3}$, 3)15.

2. In $15 \div 3$, which number is the dividend? the divisor?

NOTE. If the dividend and the divisor are concrete, they must have the same name. The quotient is then abstract. Thus, $7 (divisor) is contained in $21 (dividend) 3 times (quotient).

When the divisor is abstract and the dividend concrete, the quotient has the same name as the dividend. Thus, $21 \div 7 = 3, or $\frac{1}{7}$ of $21 = 3.

When we consider that $7 is contained 3 times in $21, the problem differs from the separation of $21 into 7 equal *parts*. The latter kind of division is called **partition**.

Give the quotients:

3. $160 \div 4$	**8.** $720 \div 24$	**13.** $750 \div 15$	**18.** $880 \div 40$
4. $280 \div 7$	**9.** $900 \div 15$	**14.** $400 \div 40$	**19.** $1200 \div 20$
5. $960 \div 8$	**10.** $500 \div 20$	**15.** $360 \div 60$	**20.** $7200 \div 60$
6. $1080 \div 12$	**11.** $900 \div 45$	**16.** $360 \div 50$	**21.** $9000 \div 60$
7. $900 \div 5$	**12.** $100 \div 25$	**17.** $900 \div 30$	**22.** $3600 \div 30$

How to divide by 10, 100, 1000, etc.

Oral Work

1. Divide 40 by 10. Cut off a zero from the right of 40. Is there any difference in the quotients? Which of these two methods of dividing is the *shorter?*

2. Divide 2436 by 100.

$$1|00)24|36$$
$$24 ; r. 36$$

3. Divide each of the following numbers by 10; by 100; by 1000: 3000; 46,000; 273,000; 619,000; 81,400; 2000; 8626; 46,153; 814,256.

Written Work

1. 81,906 sheets of paper were made up into pads of 34 sheets each. How many pads were made?

```
   2409, Quotient
34)81906, Dividend
   68
   ---
   139
   136
   ---
    306
    306
```

Notice in the third division that 30 is smaller than the divisor. Place zero in the quotient, write 6 to the right of 30, and divide 306 by 34. *Ans.* 2409 pads.

To test division, multiply the quotient by the divisor. If there is a remainder, add it to the product.

Divide and test:

2. 22,044 ÷ 44	**9.** 432,107 ÷ 31	**16.** 295,625 by 43
3. 19,095 ÷ 95	**10.** 654,321 ÷ 52	**17.** 362,181 by 63
4. 36,223 ÷ 23	**11.** 978,001 ÷ 73	**18.** 463,595 by 79
5. 46,935 ÷ 63	**12.** 803,402 ÷ 84	**19.** 736,840 by 65
6. 37,185 ÷ 88	**13.** 549,802 ÷ 95	**20.** 406,090 by 65
7. 46,221 ÷ 21	**14.** 400,001 ÷ 89	**21.** 213,965 by 133
8. 28,497 ÷ 21	**15.** 309,008 ÷ 97	**22.** 316,023 by 147

23. $70,004 by 172   **28.** 678,001 by 105   **33.** 765,432 by 509

24. $74,029 by 181   **29.** 700,000 by 220   **34.** 678,900 by 678

25. $26,686 by 378   **30.** 850,020 by 307   **35.** 394,201 by 727

26. $41,324 by 492   **31.** 449,091 by 145   **36.** 400,009 by 836

27. $87,912 by 578   **32.** 330,789 by 232   **37.** 801,020 by 905

Divide and test:

38. 6,464,341

39. 7,846,760

40. 5,864,548

41. 8,645,341   by

42. 9,624,872

43. 7,784,100

44. 6,810,404

45. 7,904,025

a. 268
b. 354
c. 676
d. 758
e. 865
f. 984
g. 789
h. 897

Form 8 groups of 8 examples each by dividing each dividend by each divisor, thus:

     38 *a.* 6,464,341 ÷ 268 = ?

     43 *c.* 7,784,100 ÷ 676 = ?

NOTE. The teacher may assign a different group to each of 8 class teams and notice which team makes the best record for accuracy and speed.

Written Work

How to divide dollars and cents.

1. If 25 bu. oats cost $20.00, find the cost per bushel.

     $.80, cost of 1 bu.
25)$20.00
   20 0
      0

Find the cost of 1 if:

3. 12 yd. cloth cost $13.44

4. 16 books cost $13.60

5. 15 yd. ribbon cost $1.35

6. 1 doz. plates cost $16.80

2. At $.18 a box, how many boxes of berries can be bought for $1.80 ?

     10, number of boxes
$.18)$1.80
    1 8
      0

Find the number if:

7. Pads at $.08 cost $3.20

8. Caps at $.72 cost $10.80

9. Plates at $.18 cost $8.10

10. Collars at $.25 cost $3.25

School Savings Banks

```
  "A PENNY SAVED
  IS A PENNY GAINED".

SCHOOL SAVINGS BANK
        OF

   Franklin School
    Lima, Ohio
  IN ACCOUNT WITH

   Anna Blake
    Cora Field
            TEACHER
```

NOTE. The smallest amount received in school savings banks varies from 1¢ to 5¢. The money should be earned by the labor of the pupil or saved by self-denial. Every school savings bank has connections with some State savings bank where each pupil's deposits are sent when they reach $1 or $5, according to the rules of the bank. The pupil then receives a regular bank book.

1. Anna Blake deposited to her school savings bank account the money she earned by making 8 jars of jelly from windfall apples and selling them at 25¢ a jar. The jars cost 5¢ apiece and she used for each jar of jelly $\frac{1}{4}$ lb. of sugar at 10¢ a pound. How much profit did she deposit?

2. One Monday 24 pupils deposited 5¢ each, 35 pupils 10¢ each, and 19 pupils 15¢ each. On the same day 4 pupils withdrew 5¢ each and 5 withdrew 15¢ each. What was the difference between the deposits and the withdrawals?

SCHOOL SAVINGS BANKS DIVISION	NO. OF DEPOSITORS	AMOUNT DEPOSITED	AMOUNT WITHDRAWN
North Atlantic Division	112,443	$2,831,196.63	$1,815,350.02
North Central Division	80,551	1,003,479.46	565,165.66
South Atlantic Division	1,748	43,951.71	39,961.80
South Central Division	1,533	6,044.50	3.00
Western Division	20,531	368,395.85	248,270.85

3. Find the total amount deposited; the amount withdrawn.

4. How much more was deposited by the North Atlantic Division than by the South Atlantic Division?

5. Find to cents the average amount deposited by each depositor; the average amount withdrawn

FACTORS AND MULTIPLES

A whole number is called an **integer** or an **integral number.**

The integers which are multiplied together to make a product are called the **factors** of the product. Thus, in $2 \times 3 = 6$, 2 and 3 are the factors of 6.

Oral Work

1. Name two factors that produce 8, 10, 12, 14, 16, 18, 20.

2. The product of two factors is 24, and one of the factors is 3. What is the other factor?

	Factor	Product	Other Factor			Factor	Product	Other Factor
3.	2	20	?		**9.**	10	40	?
4.	5	50	?		**10.**	15	30	?
5.	8	24	?		**11.**	12	60	?
6.	9	27	?		**12.**	11	77	?
7.	7	35	?		**13.**	13	52	?
8.	4	28	?		**14.**	17	68	?

When we say that 8 is a multiple of both 2 and 4, we mean that both 2 and 4 are exactly contained in 8 an *integral number* of times. 20 is a multiple of both 4 and 5, because both 4 and 5 are exactly contained in 20.

A number that contains two or more numbers an integral number of times is called a **multiple** of those numbers.

15. Find the factors of 18, as, 9×2, or 6×3. Since 18 exactly contains 9 and 2 or 6 and 3, it is a multiple of 9 and 2 and of 6 and 3.

The number 24 is a multiple of what two numbers? the number 36? 48? 16? 12?

The **dividend** in division is always the product of two factors, — the divisor and the quotient. Thus, in $48 \div 6 = 8$, 48 is the product of the factors 6 and 8.

Find the unknown terms :

	DIVISOR	DIVIDEND	QUOTIENT		DIVISOR	DIVIDEND	QUOTIENT
16.	12	144	?	26.	84	7	?
17.	10	100	?	27.	?	135	45
18.	12	600	?	28.	?	125	5
19.	12	180	?	29.	?	60	12
20.	?	288	12	30.	?	81	9
21.	?	144	12	31.	?	150	2
22.	?	450	15	32.	20	?	24
23.	?	500	10	33.	36	?	20
24.	10	?	18	34.	48	?	40
25.	20	?	40	35.	50	?	72

Written Work

	DIVISOR	DIVIDEND	QUOTIENT		DIVISOR	DIVIDEND	QUOTIENT
1.	25	650	?	11.	35	2205	?
2.	23	736	?	12.	?	2548	52
3.	51	918	?	13.	49	2793	?
4.	?	544	32	14.	36	?	46
5.	?	812	28	15.	?	2265	73
6.	24	672	?	16.	64	2816	?
7.	33	?	29	17.	37	?	39
8.	39	?	18	18.	?	1775	25
9.	16	?	38	19.	48	?	52
10.	27	?	34	20.	49	3136	?

COMMON FRACTIONS

Halves, Fourths, and Eighths

Oral Work

1 unit = $\frac{2}{2}$.   **1 unit = $\frac{4}{4}$.**   **1 unit = $\frac{8}{8}$.**

$\frac{1}{2}$ = $\frac{2}{4}$ = $\frac{4}{8}$

1. What is $\frac{1}{2}$ of 8 ? $\frac{1}{2}$ of 16 ? $\frac{1}{2}$ of 24 ?

2. What is $\frac{1}{4}$ of 8 ? $\frac{1}{4}$ of 16 ? $\frac{1}{4}$ of 24 ? $\frac{3}{4}$ of 24 ?

3. What is $\frac{1}{8}$ of 8 ? $\frac{1}{8}$ of 16 ? $\frac{1}{8}$ of 24 ? $\frac{3}{8}$ of 24 ?

4. The first circle is divided into how many equal **parts?** What is each part called ?

5. The second circle is divided into how many equal parts ? What is each part called ?

6. The third circle is divided into how many equal **parts?** What is each part called ?

7. $\frac{1}{2}$ of the first circle $= \frac{?}{4}$ of the second circle. $\frac{1}{2}$ of the first circle $= \frac{?}{8}$ of the third circle.

8. How many halves of a circle are there in a whole circle ? how many fourths of a circle ? how many eighths of a circle ?

9. Change $\frac{1}{2}$ to fourths ; thus, $\frac{1}{2} = \frac{2}{4}$.

10. Change $\frac{2}{2}$ to fourths.

11. Change $\frac{1}{2}$ to eighths ; $\frac{2}{2}$ to eighths.

12. How many units are there in $\frac{2}{2}$? $\frac{4}{4}$? $\frac{8}{8}$?

13. $\frac{1}{2}$ of the first circle $+ \frac{1}{2}$ of the first circle $=$ **how many times** the first circle ?   Then $\frac{1}{2} + \frac{1}{2} =$ how many?

14. $\frac{1}{4}$ of the second circle $+ \frac{1}{4}$ of the second circle $=$ **what part** of the second circle ?   Then $\frac{1}{4} + \frac{1}{4} =$ how many ?

15. $\frac{2}{4}$ of the second circle $+ \frac{2}{4}$ of the second circle $=$ **how many times** the second circle ?   Then $\frac{2}{4} + \frac{2}{4} =$ how many ?

16. $\frac{2}{8}$ of the third circle $= \frac{?}{4}$ of the third circle.

17. $\frac{4}{8}$ of the third circle $= \frac{?}{2}$ of the same circle.

18. $\frac{1}{4} = \frac{?}{8}$; $\frac{1}{2} = \frac{?}{8} = \frac{?}{4}$; $\frac{4}{8} = \frac{?}{2} = \frac{?}{4}$.

19. $\frac{1}{2}$ of an orange $= \frac{?}{4} = \frac{?}{8}$ of the same orange.

20. $\$\frac{1}{4} + \$\frac{1}{4} = \$\frac{?}{4}$; $\$\frac{1}{2} + \$\frac{1}{4} = \$\frac{?}{4}$.

21. $\frac{1}{8}$ day $+ \frac{1}{2}$ day $= \frac{?}{8}$ day.

22. $\$\frac{4}{4} + \$\frac{4}{4} = \$\frac{?}{4}$; $\$\frac{8}{4} =$ how many dollars ?

23. $\frac{8}{4}$ days $= -$ days ; $\frac{6}{4}$ days $= 1$ day and $\frac{?}{4}$ days.

24. Draw, in order of their size, $\frac{1}{2}$ of the first circle, $\frac{2}{4}$ of the second circle, and $\frac{3}{8}$ of the third circle.

One thing of any kind is called a **unit**; as, 1, 1 ¢, 1 boy.

One or more of the equal parts of a unit is called a **fraction**.

The number written below the line, which shows into how many equal parts the unit is divided, is called the **denominator** of a fraction.

The number written above the line, which shows how many equal parts of the unit are taken, is called the **numerator** of the fraction.

The numerator and the denominator are called the **terms** of a fraction.

A fraction may also be regarded as an **indicated division**. Thus, $\frac{9}{3} = 9 \div 3$; $\frac{3}{4} = 3 \div 4$.

When 15 is divided by 4 the remainder, 3, may be expressed as the fraction, $\frac{3}{4}$.

Express the remainders as fractions: $17 \div 4$; $18 \div 5$; $18 \div 8$; $24 \div 5$; $23 \div 6$; $71 \div 8$; $89 \div 9$; $55 \div 7$.

25. Write in figures one third; one fourth; five eighths. In the fraction $\frac{3}{4}$, what does the 4 show? the 3?

26. Read $\frac{1}{2}$; $\frac{1}{8}$; $\frac{2}{8}$; $\frac{3}{4}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{7}{8}$.

Fractions are said to be **equivalent** when they have the same value. Thus, $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{4}{8}$ are equivalent fractions.

A number made up of a whole number and a fraction is a **mixed number**; as, $4\frac{1}{2}, 3\frac{7}{8}, 5\frac{3}{4}$.

Written Work

1. Add $\frac{1}{2}$ and $\frac{3}{8}$.

$$\frac{1}{2} = \frac{4}{8}$$
$$\frac{3}{8} = \frac{3}{8}$$
$$\frac{7}{8}, \text{ Sum.}$$

Change $\frac{1}{2}$ to eighths.
The sum of $\frac{4}{8}$ and $\frac{3}{8}$ is $\frac{7}{8}$.

2. Add $2\frac{1}{2}$ and $1\frac{3}{8}$.

$$2\frac{1}{2}$$
$$1\frac{3}{8}$$
$$3\frac{7}{8}, \text{ Sum.}$$

First add the fractions as above.
Then add the whole numbers.
The sum is $3\frac{7}{8}$.

3. From $\frac{1}{2}$ subtract $\frac{3}{8}$.

$$\frac{1}{2} = \frac{4}{8}$$
$$\frac{3}{8} = \frac{3}{8}$$
$$\frac{1}{8}, \text{ Difference.}$$

Change $\frac{1}{2}$ to eighths.
The difference between $\frac{4}{8}$ and $\frac{3}{8}$ is $\frac{1}{8}$.

4. From $12\frac{1}{2}$ subtract $2\frac{3}{8}$.

$$12\frac{1}{2} = 12\frac{4}{8}$$
$$2\frac{3}{8} = 2\frac{3}{8}$$
$$10\frac{1}{8}, \text{ Difference.}$$

The difference between the fractions is $\frac{1}{8}$.
The difference between the whole numbers is 10.
The difference is therefore $10\frac{1}{8}$.

5. $\frac{1}{2} + \frac{1}{4} = ?$ $\frac{1}{2} + \frac{1}{8} = ?$ $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = ?$

6. $\frac{1}{2} + \frac{1}{2} = \frac{2}{2} = ?$ $\frac{1}{2} + \frac{5}{8} = \frac{9}{8} = ?$

7. $\frac{1}{2} + \frac{3}{4} = ?$ $\frac{3}{4} + \frac{5}{4} = ?$ $\frac{1}{2} + \frac{3}{4} + \frac{5}{4} = ?$

8. $\frac{1}{2} - \frac{1}{8} = ?$ $\frac{1}{2} - \frac{1}{4} = ?$ $\frac{3}{4} - \frac{1}{8} = ?$ $\frac{3}{4} - \frac{3}{8} = ?$

Add:

9. $3\frac{1}{2}$	10. $7\frac{1}{4}$	11. $7\frac{1}{4}$	12. $9\frac{1}{8}$	13. $5\frac{1}{8}$
$3\frac{1}{8}$	$8\frac{1}{2}$	$9\frac{3}{8}$	$6\frac{1}{2}$	$12\frac{1}{4}$

Subtract; then add:

14. $10\frac{3}{8}$	17. $12\frac{1}{2}$	20. $27\frac{3}{4}$	23. $19\frac{1}{4}$	26. $36\frac{1}{2}$
$5\frac{1}{4}$	$6\frac{1}{8}$	$8\frac{3}{8}$	$6\frac{1}{8}$	$16\frac{3}{8}$

15. $62\frac{5}{8}$	18. $63\frac{3}{4}$	21. $26\frac{3}{4}$	24. $18\frac{3}{4}$	27. $40\frac{3}{4}$
$31\frac{3}{8}$	$39\frac{1}{2}$	$24\frac{3}{8}$	$9\frac{3}{8}$	$20\frac{1}{8}$

16. $5\frac{1}{2}$	19. $9\frac{3}{4}$	22. $9\frac{1}{2}$	25. $5\frac{1}{4}$	28. $8\frac{3}{4}$
$3\frac{1}{4}$	$8\frac{1}{2}$	$3\frac{1}{2}$	4	$2\frac{1}{2}$

Add:

29. $3\frac{1}{2}$	30. $67\frac{1}{4}$	31. $65\frac{1}{2}$	32. $25\frac{3}{4}$	33. $56\frac{1}{4}$
$4\frac{1}{4}$	$6\frac{1}{2}$	$7\frac{3}{8}$	$8\frac{1}{8}$	$6\frac{1}{8}$

34. Ruth bought $\frac{1}{2}$ yd. of red ribbon and $\frac{1}{4}$ yd. of blue ribbon. How much did she buy in all?
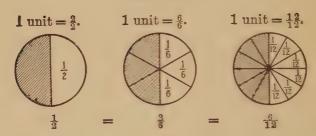
35. Marian had $1\frac{5}{8}$ yd. of linen and used $\frac{1}{2}$ yd. How much had she left?

36. John had a string $\frac{3}{4}$ yd. long from which he cut $\frac{5}{8}$ yd. How long was the part remaining?

37. Mary had $2\frac{3}{8}$ lb. of pepper, and used $\frac{1}{4}$ lb. How much had she left?

Halves, Sixths, and Twelfths

Oral Work

1 unit $= \frac{2}{2}$.   1 unit $= \frac{6}{6}$.   1 unit $= \frac{12}{12}$.

$$\frac{1}{2} \quad = \quad \frac{3}{6} \quad = \quad \frac{6}{12}$$

1. What is $\frac{1}{2}$ of 12? $\frac{1}{2}$ of 24? $\frac{1}{2}$ of 36?

2. What is $\frac{1}{6}$ of 12? $\frac{1}{6}$ of 24? $\frac{1}{6}$ of 36? $\frac{5}{6}$ of 36?

3. What is $\frac{1}{12}$ of 12? $\frac{1}{12}$ of 24? $\frac{1}{12}$ of 36? $\frac{5}{12}$ of 36?

4. $\frac{1}{2} = \frac{?}{12}$; $\frac{6}{12} = \frac{?}{2}$; $\frac{3}{6} = \frac{?}{2}$; $\frac{1}{2} = \frac{?}{6}$; $\frac{6}{12} = \frac{?}{6}$; $\frac{4}{6} + \frac{5}{6} + \frac{3}{6} = —$

5. $\frac{2}{6}$ of a circle equals $\frac{?}{12}$ of the same circle. Draw or paper and cut out circles or oblongs to show these relations.

6. Which is larger, $\frac{1}{2}$ of an apple or $\frac{5}{6}$ of the same apple? how much larger?

7. $\frac{1}{2} = \frac{?}{12}$; $\frac{1}{6} = \frac{?}{12}$; $\frac{5}{6} = \frac{?}{12}$; $\frac{24}{12} = —$ ones.

8. Show by comparing the circles above that $\frac{1}{6}$ of a circle equals $\frac{2}{12}$ of the same circle.

9. $\frac{2}{6}$ of a circle equals $\frac{?}{12}$ of the same circle.

10. Show by oblongs that $\frac{1}{2}$ of any oblong equals $\frac{3}{6}$ of the same oblong or $\frac{6}{12}$ of the same oblong.

11. Show that $\frac{1}{2}$ of any unit is greater in size than $\frac{5}{12}$ of the same unit.

12. How many halves of a unit are there in a unit? how many sixths? how many twelfths?

13. Arrange the following in order of their size:

$$\frac{1}{2}, \ \frac{1}{6}, \ \frac{1}{12}, \ \frac{2}{2}, \ \frac{6}{6}, \ \frac{3}{2}, \ \frac{12}{6}, \ \frac{12}{12}, \ \frac{4}{2}, \ \frac{24}{12}.$$

Written Work

1. Add $\frac{5}{6}$ and $\frac{5}{12}$.

$$\frac{5}{6} = \frac{10}{12}$$
$$\frac{5}{12} = \frac{5}{12}$$
$$\frac{15}{12} = 1\frac{3}{12}, \text{ or } 1\frac{1}{4}, \text{ Sum.}$$

Change the fraction $\frac{5}{6}$ to twelfths.
The sum of $\frac{10}{12}$ and $\frac{5}{12}$ is $\frac{15}{12}$, or $1\frac{3}{12}$, or $1\frac{1}{4}$.

2. Add $3\frac{5}{6}$ and $2\frac{5}{12}$.

$$3\frac{5}{6} = 3\frac{10}{12}$$
$$2\frac{5}{12} = 2\frac{5}{12}$$
$$6\frac{1}{4}, \text{ Sum.}$$

First add the fractions as above; $1\frac{5}{12} = 1\frac{1}{4}$. Write $\frac{1}{4}$ and carry the 1.
The sum of the whole numbers is $1 + 2 + 3$, or 6. The sum is therefore $6\frac{1}{4}$.

3. From $\frac{5}{6}$ subtract $\frac{5}{12}$.

$$\frac{5}{6} = \frac{10}{12}$$
$$\frac{5}{12} = \frac{5}{12}$$
$$\frac{5}{12}, \text{ Difference.}$$

Change $\frac{5}{6}$ to twelfths.
The difference between $\frac{10}{12}$ and $\frac{5}{12}$ is $\frac{5}{12}$.

4. From $3\frac{5}{6}$ subtract $2\frac{5}{12}$.

$$3\frac{5}{6} = 3\frac{10}{12}$$
$$2\frac{5}{12} = 2\frac{5}{12}$$
$$1\frac{5}{12}, \text{ Difference.}$$

The difference between the fractions is $\frac{5}{12}$.
The difference between the whole numbers is 1. The difference is therefore $1\frac{5}{12}$.

Add :

5. $\frac{1}{2} + \frac{1}{6}$ **6.** $\frac{1}{6} + \frac{5}{12}$ **7.** $1\frac{1}{2} + 2\frac{1}{6}$ **8.** $3\frac{7}{12} + 1\frac{1}{6}$

Subtract :

9. $\frac{1}{2} - \frac{1}{6}$ **10.** $\frac{5}{6} - \frac{5}{12}$ **11.** $3\frac{7}{12} - 1\frac{1}{2}$ **12.** $4\frac{5}{6} - 3\frac{1}{2}$

First add ; then subtract :

13. $8\frac{5}{12}$ **14.** $9\frac{11}{12}$ **15.** $7\frac{5}{6}$ **16.** $9\frac{7}{12}$ **17.** $12\frac{5}{6}$
    $2\frac{1}{6}$ $6\frac{5}{6}$ $5\frac{5}{12}$ $8\frac{1}{2}$ $10\frac{5}{12}$

** — 8

18. $11\frac{1}{2}$ **19.** $6\frac{1}{2}$ **20.** $41\frac{5}{6}$ **21.** $16\frac{1}{2}$ **22.** $15\frac{7}{12}$
    $\underline{4\frac{1}{6}}$ $\underline{5\frac{1}{12}}$ $\underline{16\frac{7}{12}}$ $\underline{12\frac{1}{6}}$ $\underline{5\frac{1}{2}}$

23. Julia bought $\frac{1}{12}$ doz. pearl buttons and $\frac{5}{6}$ doz. bone buttons. What part of a dozen did she buy in all? How many buttons?

24. James worked $3\frac{5}{6}$ hr. on Saturday and $1\frac{1}{2}$ hr. on Monday. How many hours did he work both days? How many more hours did he work on Saturday than on Monday?

25. Robert's marks for the month average $91\frac{5}{6}$, and John's average $89\frac{1}{2}$. Find the difference in their averages.

Thirds, Sixths, and Ninths

Oral Work

1 unit = $\frac{3}{3}$.   1 unit = $\frac{6}{6}$.   1 unit = $\frac{9}{9}$.

$\frac{1}{3}$ = $\frac{2}{6}$ = $\frac{3}{9}$

1. What is $\frac{1}{3}$ of 6? $\frac{1}{3}$ of 12? $\frac{1}{3}$ of 18? $\frac{2}{3}$ of 18?

2. What is $\frac{1}{6}$ of 6? $\frac{1}{6}$ of 12? $\frac{1}{6}$ of 18? $\frac{5}{6}$ of 18?

3. What is $\frac{1}{9}$ of 9? $\frac{1}{9}$ of 18? $\frac{1}{9}$ of 27? $\frac{4}{9}$ of 27?

4. Into how many equal parts is the first circle divided? the second circle? the third circle?

5. $\frac{1}{3}$ of a circle = $\frac{?}{6}$ of the circle = $\frac{?}{9}$ of the circle.

6. $\frac{2}{3}$ of a circle = $\frac{?}{6}$ of the circle = $\frac{?}{9}$ of the circle

7. $\frac{3}{3}$ of a circle $= \frac{?}{6}$ of the circle $= \frac{?}{9}$ of the circle.

8. $\frac{1}{3} + \frac{2}{6} = \frac{?}{6}$; $\frac{1}{3} + \frac{3}{9} = \frac{?}{9}$; $\frac{1}{3} + \frac{3}{6} = \frac{?}{6}$.

9. $\frac{1}{3}$ of an hour $+ \frac{1}{6}$ of an hour $= \frac{?}{6}$ of an hour.

10. $\frac{2}{3}$ of a day $+ \frac{2}{9}$ of a day $= \frac{?}{9}$ of a day.

11. $\frac{1}{3} + \frac{1}{6} = —$; $\frac{1}{3} + \frac{1}{9} = —$; $\frac{1}{2} + \frac{1}{6} = —$; $\frac{2}{3} + \frac{1}{6} = —$.

12. Draw an oblong and show that $\frac{1}{3}$ of the oblong $= \frac{2}{6}$ of the oblong $= \frac{3}{9}$ of the oblong.

13. $\frac{1}{3} = \frac{?}{6}$; $\frac{2}{3} = \frac{?}{6}$; $\frac{2}{3} = \frac{?}{9}$; $\frac{3}{3} = \frac{?}{9}$.

14. Draw squares and show that $\frac{1}{3} = \frac{2}{6}$; that $\frac{2}{3} = \frac{4}{6}$; that $\frac{1}{3} = \frac{3}{9}$; that $\frac{2}{3} = \frac{6}{9}$.

15. How many thirds equal one unit? how many sixths? how many ninths?

16. $\frac{6}{3} =$ how many units? $\frac{12}{6} =$ how many units? $\frac{18}{6} =$ how many units? $\frac{9}{3} =$ how many units?

Fractional Parts of the Foot and the Yard

Oral Work

In the following diagrams of one foot and one yard, $\frac{1}{4}$ inch stands for 1 foot.

One foot.   *One yard.*

1. A foot is what part of a yard?

2. 2 feet are what part of a yard?

3. How many feet equal $\frac{1}{3}$ of a yard? $\frac{2}{3}$ of a yard?

4. Measure a yard on the blackboard. Divide the yard into feet. Divide a foot into inches.

5. How many inches equal $\frac{1}{2}$ of a foot? $\frac{2}{3}$ of a foot? $\frac{1}{4}$ of a foot? $1\frac{1}{2}$ ft.? $2\frac{1}{2}$ ft.?

6. 6 in. are what part of a foot ? of 2 feet? of a yard ?

7. 4 in. are what part of a foot ? of 2 feet?

8. $1\frac{1}{2}$ ft. $+ 1\frac{1}{2}$ ft. $= \underline{\quad}$ ft.

9. $\frac{1}{2} = \frac{?}{4}$; $\frac{1}{2} + \frac{1}{4} = \frac{?}{4}$; $\frac{1}{2} = \frac{?}{6}$, $\frac{1}{2} + \frac{3}{6} = \frac{?}{6}$.

10. $1\frac{1}{4}$ ft. $+ \frac{1}{2}$ ft. $=$ how many feet ? $1\frac{1}{4} + \frac{1}{2} = \underline{\quad}$.

11. $\frac{1}{3}$ yd. $+ \frac{1}{2}$ yd. $+ \frac{1}{6}$ yd. $= \underline{\quad}$ yd. $= \underline{\quad}$ ft.

12. $2\frac{1}{3}$ ft. $+ 3\frac{2}{3}$ ft. $= \underline{\quad}$ ft. $= \underline{\quad}$ yd.

13. $\frac{3}{4}$ ft. $+ \frac{1}{4}$ ft. $= \underline{\quad}$ ft.; $\frac{3}{4}$ ft. $+ \frac{3}{4}$ ft. $+ \frac{2}{4}$ ft. $= \underline{\quad}$ ft.

14. $\frac{4}{2}$ ft. $= \underline{\quad}$ ft.; $\frac{6}{3}$ ft. $= \underline{\quad}$ ft.; $\frac{6}{4}$ ft. $= \underline{\quad}$ ft.

Written Work

Add:

1. $2\frac{1}{4}$ in.	2. $5\frac{1}{2}$ yd.	3. $6\frac{1}{2}$ ft.	4. $2\frac{1}{3}$ ft.
$3\frac{1}{2}$ in.	$8\frac{1}{6}$ yd.	$2\frac{1}{4}$ ft.	$8\frac{1}{6}$ ft.

Subtract :

5. $3\frac{3}{4}$ ft.	6. $7\frac{1}{3}$ yd.	7. $3\frac{1}{3}$ ft.	8. $20\frac{1}{2}$ ft.
$2\frac{3}{4}$ ft.	$6\frac{1}{6}$ yd.	$2\frac{1}{6}$ ft.	$15\frac{1}{6}$ ft.

Review — Written Work

Add:

1. $11\frac{1}{8}$	4. $3\frac{1}{3}$	7. $29\frac{1}{2}$	10. $97\frac{3}{8}$	13. $10\frac{5}{6}$
$5\frac{1}{8}$	$2\frac{5}{6}$	$6\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{8}$
$2\frac{1}{2}$	$12\frac{1}{6}$	$18\frac{1}{2}$	$\frac{1}{8}$	$4\frac{1}{4}$

2. $6\frac{2}{3}$	5. $11\frac{1}{3}$	8. $17\frac{3}{4}$	11. $8\frac{1}{4}$	14. $80\frac{3}{4}$
$4\frac{1}{2}$	$5\frac{5}{6}$	$5\frac{5}{8}$	$3\frac{3}{4}$	$4\frac{1}{2}$
$2\frac{1}{2}$	$3\frac{1}{3}$	$4\frac{1}{4}$	$\frac{1}{2}$	$70\frac{1}{6}$

3. $6\frac{1}{2}$	6. $40\frac{1}{4}$	9. $90\frac{1}{6}$	12. $7\frac{1}{2}$	15. $24\frac{1}{3}$
$12\frac{3}{4}$	$16\frac{1}{2}$	$2\frac{1}{3}$	$4\frac{7}{8}$	$5\frac{4}{9}$
$2\frac{1}{2}$	$5\frac{5}{8}$	$7\frac{5}{6}$	$2\frac{1}{2}$	$3\frac{7}{8}$

Subtract:

16. $25\frac{2}{3}$ $17\frac{1}{6}$	**21.** $87\frac{3}{4}$ $14\frac{1}{2}$	**26.** $80\frac{11}{12}$ $16\frac{5}{6}$	**31.** $57\frac{7}{9}$ $16\frac{2}{3}$
17. $16\frac{7}{12}$ $4\frac{1}{2}$	**22.** $25\frac{1}{4}$ $16\frac{1}{8}$	**27.** $45\frac{5}{6}$ $16\frac{1}{2}$	**32.** $14\frac{7}{8}$ $10\frac{1}{2}$
18. $19\frac{1}{2}$ $16\frac{1}{6}$	**23.** $37\frac{7}{8}$ $16\frac{3}{4}$	**28.** $17\frac{3}{4}$ $16\frac{3}{8}$	**33.** $13\frac{8}{9}$ $4\frac{2}{3}$
19. $8\frac{7}{9}$ $5\frac{2}{3}$	**24.** $15\frac{5}{6}$ $13\frac{1}{2}$	**29.** $49\frac{3}{4}$ $20\frac{3}{8}$	**34.** $6\frac{3}{4}$ $4\frac{1}{2}$
20. $13\frac{7}{8}$ $10\frac{3}{4}$	**25.** $20\frac{2}{3}$ $16\frac{1}{6}$	**30.** $16\frac{7}{8}$ $12\frac{3}{4}$	**35.** $27\frac{5}{8}$ $1\frac{1}{4}$
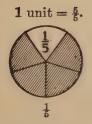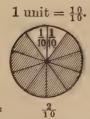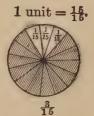
Fifths, Tenths, and Fifteenths

Oral Work

1 unit $= \frac{5}{5}$.　　1 unit $= \frac{10}{10}$.　　1 unit $= \frac{15}{15}$.

$\frac{1}{5}$　　$=$　　$\frac{2}{10}$　　$=$　　$\frac{3}{15}$

1. What is $\frac{2}{5}$ of 25?　$\frac{3}{10}$ of 20?　$\frac{2}{15}$ of 30?

2. Into how many equal parts is the first circle divided? the second circle? the third circle?

3. Observe the parts of each circle that are not

$\frac{1}{5} = \frac{?}{10} = \frac{?}{15}$

4. Then $\frac{2}{5} = \frac{?}{10} = \frac{?}{15}$; $\frac{3}{5} = \frac{?}{10} = \frac{?}{15}$; $\frac{4}{5} = \frac{?}{10} = \frac{?}{15}$.

5. Each of five boys had $\frac{1}{5}$ of a dollar. How many dollars did all have?

6. $\frac{2}{5}$ of a circle $+ \frac{2}{5}$ of the same circle $= \frac{?}{5}$ of the circle. Then $\frac{2}{5} + \frac{2}{5} = \frac{?}{5}$; $\frac{4}{5} - \frac{2}{5} = \frac{?}{5}$; $\frac{4}{5} - \frac{3}{5} = \frac{?}{5}$.

7. How many parts of a unit are there in $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$? in $\frac{3}{5} + \frac{2}{5}$? in $\frac{2}{10} + \frac{5}{10} + \frac{3}{10}$? in $\frac{3}{15} + \frac{8}{15} + \frac{3}{15}$? in $\frac{5}{15} - \frac{3}{15}$?

8. $\frac{1}{5} + \frac{1}{10} = \frac{?}{10}$; $\frac{1}{5} + \frac{1}{15} = \frac{?}{15}$; $\frac{1}{5} + \frac{1}{5} = \frac{?}{15}$.

9. $\frac{5}{5} + \frac{5}{5} = \frac{?}{5}$. Then $\frac{10}{5} =$ how many units?

10. $\frac{8}{5} =$ how many units and $\frac{3}{5}$ remaining?

11. $\frac{12}{5} =$ how many units and $\frac{2}{5}$ remaining?

12. $\frac{15}{10} =$ how many units and $\frac{5}{10}$ remaining?

13. Change to units and parts of units: $\frac{6}{5}$, $\frac{9}{5}$, $\frac{11}{5}$, $\frac{13}{10}$.

Written Work

Add:

1. $\$2\frac{1}{5}$	**2.** $\$11\frac{1}{5}$	**3.** $25\frac{3}{5}$ mi.	**4.** $5\frac{1}{15}$
$3\frac{1}{10}$	$5\frac{3}{10}$	$4\frac{1}{10}$ mi.	$4\frac{1}{5}$

5. $24\frac{1}{5}$ mi.	**6.** $\$23\frac{1}{5}$	**7.** $50\frac{1}{5}$	**8.** $24\frac{1}{5}$ da.
$4\frac{1}{15}$ mi.	$7\frac{3}{10}$	$35\frac{2}{15}$	$3\frac{3}{10}$ da.
$5\frac{1}{5}$ mi.	$31\frac{1}{10}$	$4\frac{4}{5}$	$4\frac{1}{5}$ da.

Subtract:

9. $\$3\frac{1}{5}$	**10.** $25\frac{1}{5}$ hr.	**11.** $\$14\frac{2}{5}$	**12.** $78\frac{3}{5}$ min.
$2\frac{1}{10}$	$13\frac{1}{15}$ hr.	$10\frac{1}{10}$	$42\frac{1}{15}$ min.

13. James works in his school garden $1\frac{1}{10}$ hours each day; John works $2\frac{4}{5}$ hours; and Frank, $1\frac{3}{10}$ hours. How many hours do they all work?

14. Jane walks to school in $\frac{1}{5}$ hr. and Martha in $\frac{1}{10}$ hr. What part of an hour longer does it take Jane than Martha? how many minutes longer?

15. From Philip's house to school it is $\frac{2}{5}$ mi.; to the ball grounds it is $\frac{1}{10}$ mi. further. How far is it from Philip's house to the ball grounds?

16. Mary earns $\$\frac{3}{10}$, Henry earns $\$\frac{2}{5}$, and Rose earns $\$\frac{1}{5}$. What part of a dollar do they earn together?

Add:

17. $3\frac{3}{5}$
 $2\frac{1}{15}$

18. $3\frac{4}{15}$
 $3\frac{2}{5}$

19. $2\frac{1}{5}$
 $3\frac{7}{10}$

20. $5\frac{2}{5}$
 $7\frac{3}{10}$

21. $1\frac{7}{10}$
 $2\frac{4}{5}$

22. $3\frac{1}{15}$
 $4\frac{1}{5}$

23. $3\frac{7}{15}$
 $2\frac{4}{5}$

24. $3\frac{9}{10}$
 $2\frac{1}{5}$

Subtract:
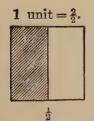
25. $5\frac{4}{5}$
 $2\frac{1}{10}$
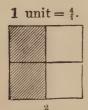
26. $3\frac{3}{10}$
 $1\frac{1}{5}$

27. $2\frac{9}{10}$
 $1\frac{3}{5}$
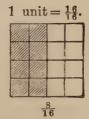
28. $3\frac{7}{15}$
 $2\frac{1}{5}$

Halves, Fourths, and Sixteenths

Oral Work

1 unit $= \frac{2}{2}$. 1 unit $= \frac{4}{4}$. 1 unit $= \frac{16}{16}$.

$\frac{1}{2}$ $=$ $\frac{2}{4}$ $=$ $\frac{8}{16}$

1. How do these three units compare in size?

2. Into how many equal parts is the first square divided? the second square? the third square?

3. $\frac{1}{2}$ of the first square $=$ — fourths of the second square $=$ — sixteenths of the third square.

4. $\frac{2}{2} =$ — unit; $\frac{4}{4} =$ — unit; $\frac{8}{8} =$ — unit; $\frac{16}{16} =$ — unit.

5. $\frac{1}{2} = \frac{?}{4} = \frac{?}{8} = \frac{?}{16}.$ **6.** $\frac{1}{4} = \frac{?}{8} = \frac{?}{16}.$

7. $\frac{2}{4} = \frac{?}{8} = \frac{?}{16}$; $\frac{3}{4} = \frac{?}{8} = \frac{?}{16}.$

8. $\frac{1}{8} = \frac{?}{16}$; $\frac{2}{8} = \frac{?}{16} = \frac{?}{4}$; $\frac{4}{8} = \frac{?}{16} = \frac{?}{2}$; $\frac{6}{8} = \frac{?}{16} = \frac{?}{4}.$

9. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{?}{8}$; $\frac{1}{4} + \frac{3}{8} + \frac{3}{16} = \frac{?}{16}$; $\frac{9}{16} - \frac{1}{4} = \frac{?}{16}.$

Written Work

Add:

1.	2.	3.	4.
$3\frac{1}{16}$ ft.	\$$16\frac{1}{2}$	$12\frac{1}{4}$	$10\frac{3}{16}$
$5\frac{1}{4}$ ft.	$20\frac{3}{4}$	$14\frac{1}{2}$	$5\frac{1}{2}$
$2\frac{1}{2}$ ft.	$17\frac{1}{16}$	$10\frac{5}{16}$	$6\frac{3}{4}$

Subtract:

5.	6.	7.	8.
\$$12\frac{1}{2}$	$23\frac{3}{4}$ yd.	$13\frac{1}{2}$ mi.	$68\frac{3}{4}$
$8\frac{1}{16}$	$18\frac{3}{16}$ yd.	$9\frac{3}{16}$ mi.	$52\frac{5}{16}$

9. A flower bed is $4\frac{1}{2}$ ft. long and $3\frac{1}{4}$ ft. wide. Find the distance around it.

10. The school ground is in the form of a square, $13\frac{1}{2}$ rd. on a side. Find the distance in rods around it.

11. I cut $\frac{1}{2}$ yd. of ribbon from $3\frac{3}{4}$ yd. How much ribbon have I left?

12. A stick $5\frac{3}{16}$ in. long is broken in two pieces. One piece is $3\frac{1}{8}$ in. long. How long is the other piece?

13. I pay \$$3\frac{1}{2}$ for a chair, and \$$4\frac{3}{4}$ for a table. What is my total bill?

Thirds, Sixths, and Twelfths

Oral Work

$$1 \text{ unit} = \tfrac{3}{3} = \tfrac{6}{6} = \tfrac{12}{12}.$$

1. Show by the diagram how many sixths are equal to one third. Show also how many twelfths are equal to one sixth.

2. $\tfrac{1}{3} = \tfrac{?}{6} = \tfrac{?}{12}$; $\tfrac{2}{3} = \tfrac{?}{6} = \tfrac{?}{12}$.

3. Cut a paper oblong and fold it into thirds; into sixths; into twelfths.

4. $\tfrac{1}{3}$ hour $= \tfrac{?}{12}$ of an hour; $\tfrac{1}{6}$ hour $= \tfrac{?}{12}$ of an hour.

5. Change $\tfrac{1}{3}$ and $\tfrac{1}{6}$ to twelfths. Change $\tfrac{4}{12}$ to thirds.

6. Cut three oblongs of the same size out of paper. Fold the first oblong into thirds; the second oblong into sixths; and the third oblong into twelfths.

7. Change $\tfrac{2}{3}$ and $\tfrac{5}{6}$ to twelfths. Change $\tfrac{8}{12}$ to sixths.

8. $\tfrac{4}{12}$ of an oblong equal how many thirds of the oblong?

9. $\tfrac{12}{12}$ equal how many units; $\tfrac{12}{6}$ equal how many units?

Add:

10. $\tfrac{1}{3}, \tfrac{1}{6}, \tfrac{1}{12}$	**15.** $3\tfrac{1}{3}, 4\tfrac{1}{6}$	**20.** $3\tfrac{1}{3}, 3\tfrac{1}{6}, 2\tfrac{1}{12}$
11. $\tfrac{2}{3}, \tfrac{1}{6}, \tfrac{1}{12}$	**16.** $2\tfrac{2}{3}, 3\tfrac{1}{12}$	**21.** $2\tfrac{1}{6}, 2\tfrac{1}{3}, 2\tfrac{5}{6}$
12. $\tfrac{2}{3}, \tfrac{1}{12}, \tfrac{5}{12}$	**17.** $4\tfrac{1}{6}, 5\tfrac{1}{12}$	**22.** $2\tfrac{1}{12}, 2\tfrac{1}{6}, \tfrac{1}{3}$
13. $\tfrac{1}{3}, \tfrac{5}{6}, \tfrac{1}{12}$	**18.** $5\tfrac{1}{12}, 6\tfrac{2}{3}$	**23.** $3\tfrac{1}{3}, 2\tfrac{7}{12}, 5\tfrac{5}{12}$
14. $\tfrac{1}{3}, \tfrac{7}{12}, \tfrac{5}{6}$	**19.** $7\tfrac{1}{6}, 8\tfrac{2}{3}$	**24.** $3\tfrac{1}{3}, 4\tfrac{1}{6}, 5\tfrac{1}{12}$

Written Work

1. Change to units and parts of units : $\frac{3}{2}$, $\frac{9}{8}$, $\frac{10}{8}$, $\frac{12}{6}$, $\frac{15}{10}$, $\frac{8}{8}$, $\frac{18}{10}$, $\frac{18}{15}$, $\frac{20}{16}$.

Add:

2.	$29\frac{1}{3}$	**4.**	$7\frac{1}{3}$	**6.**	$39\frac{1}{6}$	**8.**	$5\frac{1}{3}$
	$32\frac{1}{6}$		$10\frac{5}{6}$		$42\frac{5}{12}$		$6\frac{5}{6}$
	$45\frac{5}{12}$		$25\frac{1}{12}$		$23\frac{2}{3}$		$12\frac{7}{12}$
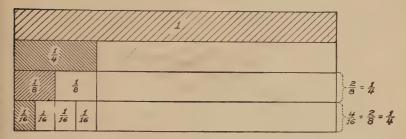
3.	$27\frac{5}{12}$ ft.	**5.**	$15\frac{7}{12}$ mi.	**7.**	$14\frac{1}{12}$ doz.	**9.**	$12\frac{1}{3}$ da.
	$45\frac{1}{3}$ ft.		$29\frac{2}{3}$ mi.		$19\frac{1}{2}$ doz.		$10\frac{1}{6}$ da.
	$25\frac{5}{6}$ ft.		$31\frac{5}{6}$ mi.		$16\frac{5}{6}$ doz.		$13\frac{1}{12}$ da.

Subtract:

10.	$8\frac{1}{3}$	**12.**	$17\frac{1}{3}$	**14.**	$14\frac{2}{3}$	**16.**	$32\frac{5}{12}$
	$6\frac{1}{12}$		$15\frac{1}{12}$		$12\frac{1}{12}$		$30\frac{1}{3}$

11.	$7\frac{2}{3}$ ft.	**13.**	$9\frac{2}{3}$ mi.	**15.**	$10\frac{1}{3}$ doz.	**17.**	$15\frac{11}{12}$
	$5\frac{5}{12}$ ft.		$7\frac{1}{12}$ mi.		$6\frac{1}{12}$ doz.		$5\frac{2}{3}$

18. The floor of a room is $13\frac{5}{6}$ ft. long and $12\frac{1}{3}$ ft. wide. Find the distance around the room. How much longer is the room than it is wide?

19. Mary's hair ribbon is $15\frac{1}{3}$ in. long and $1\frac{1}{6}$ in. wide. Find the difference between the length and the width of the ribbon.

20. James worked after school $1\frac{5}{6}$ hr. Monday, $1\frac{1}{6}$ hr. Tuesday, $1\frac{1}{12}$ hr. Wednesday, 2 hr. Thursday, and $1\frac{5}{6}$ hr. Friday. On Saturday he worked $10\frac{1}{3}$ hr. How many hours did he work during the week?

21. Walter lives $1\frac{2}{3}$ mi. from school, and Peter $1\frac{1}{6}$ mi. in the same direction. In going to school, Walter walks how much farther than Peter? Find the distance both walk in going to and coming from school in a day.

Fourths, Eighths, and Sixteenths

Oral Work

$\frac{2}{8} = \frac{1}{4}$

$\frac{4}{16} = \frac{2}{8} = \frac{1}{4}$

1. Show by the diagram how many eighths are equal to one fourth; how many sixteenths are equal to one eighth; how many sixteenths are equal to one fourth.

2. $\frac{2}{8} = \frac{?}{16}$; $\frac{2}{8} = \frac{?}{4}$; $\frac{4}{16} = \frac{?}{4}$; $\frac{4}{16} = \frac{?}{8}$.

3. Any unit can be divided into how many halves? 3ds? 4ths? 5ths? 6ths? 7ths? 8ths? 10ths? 16ths? 24ths?

4. Add $\frac{1}{4}$ and $\frac{1}{8}$; $\frac{1}{8}$ and $\frac{1}{16}$. From $\frac{7}{8}$ take $\frac{1}{4}$.

5. From $\frac{9}{16}$ take $\frac{1}{8}$; $\frac{1}{4}$; $\frac{1}{2}$; $\frac{3}{8}$.

6. $\frac{5}{4}$ means that a unit ($\frac{4}{4}$) and a part of a unit ($\frac{1}{4}$) have been added. What does $\frac{9}{8}$ mean? $1\frac{7}{16}$?

Written Work

Add :

1. $18\frac{1}{4}$ in.	**2.** $15\frac{1}{16}$	**3.** $19\frac{1}{4}$	**4.** $40\frac{7}{8}$
$20\frac{1}{8}$ in.	$27\frac{1}{8}$	$32\frac{3}{16}$	$30\frac{1}{16}$
$39\frac{1}{16}$ in.	$41\frac{3}{4}$	$20\frac{1}{8}$	$18\frac{1}{4}$

Subtract :

5. $9\frac{1}{8}$ in.	**6.** $14\frac{1}{4}$ da.	**7.** $28\frac{11}{16}$	**8.** $39\frac{7}{16}$
$7\frac{1}{16}$ in.	$7\frac{1}{8}$ da.	$13\frac{3}{8}$	$8\frac{1}{4}$

REDUCTION OF FRACTIONS

1. Notice in the diagram that $\frac{1}{4} = \frac{4}{16}$. By what number are both the numerator and the denominator of $\frac{1}{4}$ *multiplied* to change it to $\frac{4}{16}$? Is there any difference in *value* between $\frac{1}{4}$ and $\frac{4}{16}$? Notice that the *terms* in $\frac{4}{16}$ are larger or *higher* than in $\frac{1}{4}$. The changing of $\frac{1}{4}$ to the equal fraction $\frac{4}{16}$ is called **changing or reducing $\frac{1}{4}$ to higher terms.**

2. By what number must both terms of $\frac{4}{16}$ be *divided* to change $\frac{4}{16}$ to $\frac{2}{8}$? Is there any difference in *value* between $\frac{4}{16}$ and $\frac{2}{8}$? Which fraction has the *lower terms?* The changing of $\frac{4}{16}$ to $\frac{2}{8}$ is called **reducing $\frac{4}{16}$ to lower terms.**

3. Notice in the diagram that $\frac{4}{16} = \frac{2}{8} = \frac{1}{4}$. When $\frac{4}{16}$ is changed to $\frac{2}{8}$ it is reduced to *lower* terms but not to its *lowest terms*, since $\frac{2}{8}$ can be changed to still lower terms, $\frac{1}{4}$. Can $\frac{1}{4}$ be reduced to still lower terms? The changing of $\frac{4}{16}$ to $\frac{1}{4}$ is called **reducing $\frac{4}{16}$ to its lowest terms.**

4. By what number must both terms of $\frac{1}{2}$ be multiplied to change it to the equal fraction $\frac{3}{6}$? By what number must both terms of $\frac{8}{10}$ be divided to change it to the equal fraction $\frac{4}{5}$? Is $\frac{4}{5}$ in its lowest terms?

The value of a fraction is not changed when both terms are multiplied or divided by the same number.

Read in lowest terms at sight:

5. $\frac{2}{4}$; $\frac{8}{16}$; $\frac{6}{9}$; $\frac{3}{4}$; $\frac{12}{16}$; $\frac{10}{15}$; $\frac{7}{9}$; $\frac{2}{6}$; $\frac{9}{12}$; $\frac{9}{15}$; $\frac{6}{8}$; $\frac{8}{10}$; $\frac{4}{6}$.

Any unit may be divided into any number of equal parts and any part may be used as a *unit of measure.* Thus, $\frac{3}{4}$ means $3 \times \frac{1}{4}$, the *unit of measure.*

Oral Work

A fraction is changed to **higher terms** when it is changed to a fraction having a *larger denominator*.

Thus,$\qquad\qquad \frac{1}{2} = \frac{2}{4} = \frac{4}{8} = \frac{8}{16}.$

A fraction is changed to **lower terms** when it is changed to a fraction having a *smaller denominator*.

Thus,$\qquad\qquad \frac{8}{16} = \frac{4}{8} = \frac{2}{4} = \frac{1}{2}.$

Give the equivalents called for and explain the steps in the work. Thus, dividing both terms of $\frac{8}{12}$ by 4 gives $\frac{2}{3}$; multiplying both terms of $\frac{2}{3}$ by 4 gives $\frac{8}{12}$.

1. $\frac{1}{4} = \frac{?}{8} = \frac{?}{16} = \frac{?}{24}.$ **2.** $\frac{2}{3} = \frac{?}{6} = \frac{?}{9} = \frac{?}{12} = \frac{?}{18}.$

3. $\frac{3}{4} = \frac{?}{8} = \frac{?}{12} = \frac{?}{16} = \frac{?}{20} = \frac{?}{24} = \frac{?}{28} = \frac{?}{32}.$

Change :

4. $\frac{3}{9}$ to thirds.

5. $\frac{4}{12}$ to thirds.

6. $\frac{5}{10}$ to halves.

7. $\frac{3}{18}$ to sixths.

8. $\frac{4}{16}$ to fourths.

9. $\frac{1}{8}$ to ninths.

10. $\frac{3}{4}$ to twelfths.

11. $\frac{2}{5}$ to tenths.

12. $\frac{2}{3}$ to sixths.

13. $\frac{3}{4}$ to eighths.

14. Change $\frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{7}{6}, \frac{5}{6}, \frac{7}{12}, \frac{5}{8}, \frac{5}{12}$, each to twenty-fourths.

15. Change $\frac{10}{12}, \frac{15}{18}, \frac{16}{24}, \frac{10}{30}, \frac{12}{24}, \frac{25}{30}$, each to sixths.

Change :

16. $\frac{3}{6}$ to halves.

17. $\frac{3}{12}$ to fourths.

18. $\frac{2}{20}$ to tenths.

19. $\frac{2}{16}$ to eighths.

20. $\frac{5}{25}$ to fifths.

21. $\frac{4}{12}$ to sixths.

22. $\frac{5}{6}$ to twelfths.

23. $\frac{1}{2}$ to eighths.

24. $\frac{4}{5}$ to tenths.

25. $\frac{3}{5}$ to fifteenths.

26. $\frac{3}{4}$ to sixteenths.

27. $\frac{3}{4}$ to twenty-fourths.

Oral and Written Work

1. Divide 10, 12, 24, 36, 38, and 50, each by 2. **Divide** other numbers ending in 2, 4, 6, 8, or 0 by 2.

A number is divisible by 2 if the ones' figure is **2, 4, 6, 8** *or* **0.**

Change to lowest terms:

2. $\frac{8}{12}$, $\frac{6}{24}$, $\frac{20}{24}$, $\frac{24}{32}$, $\frac{22}{40}$, $\frac{38}{40}$, $\frac{16}{30}$, $\frac{17}{20}$, $\frac{9}{10}$.

3. Change $\frac{36}{40}$ to lowest terms. Thus, $\frac{36}{40} = \frac{18}{20} = \frac{9}{10}$. **Or,** if you notice that 4 divides both 36 and 40, you **may** **divide** these numbers by 4 and say at once $\frac{36}{40} = \frac{9}{10}$.

4. Divide 15, 25, 40, 125, 150, each by 5. What is **the** ones' figure in each dividend? Divide other numbers end· ing in 5 or 0 by 5.

A number is divisible by 5 if its ones' figure is **5** *or* **0.**

Change to lowest terms:

5. $\frac{15}{20}$, $\frac{10}{40}$, $\frac{25}{40}$, $\frac{30}{35}$, $\frac{45}{60}$, $\frac{20}{40}$, $\frac{50}{150}$, $\frac{15}{60}$.

A number is divisible by 3 if the sum of its digits, or figures, is divisible by 3. Thus, 216 is divisible by 3, since $2 + 1 + 6$, or 9, is divisible by 3.

A number is divisible by 9 if the sum of its digits is divisible by 9. Thus, 369 is divisible by 9, since $3 + 6 + 9$, or 18, is divisible by 9.

6. Name the numbers to 63 that are divisible by 9 ; **by 3.**

7. Change to lowest terms :

$\frac{36}{54}$, $\frac{12}{36}$, $\frac{12}{42}$, $\frac{54}{135}$, $\frac{27}{54}$, $\frac{105}{120}$, $\frac{36}{96}$, $\frac{120}{360}$, $\frac{126}{174}$, $\frac{72}{144}$, $\frac{48}{96}$, $\frac{75}{153}$.

Change to fractions in their lowest terms :

8. $\frac{81}{144}$ $\frac{120}{140}$ $\frac{108}{132}$ $\frac{108}{126}$ $\frac{99}{132}$ $\frac{72}{108}$

9. $\frac{60}{144}$ $\frac{90}{140}$ $\frac{105}{350}$ $\frac{144}{288}$ $\frac{144}{168}$ $\frac{120}{132}$

10. $\frac{100}{225}$ $\frac{75}{105}$ $\frac{320}{400}$ $\frac{80}{128}$ $\frac{216}{264}$ $\frac{153}{168}$

How to change improper fractions to whole or mixed numbers.

Oral Work

1. Name the whole numbers and the **fractions** in 5, $1\frac{5}{2}$, $\frac{7}{4}$ ft., $6\frac{4}{6}$ lb., \$20, $2\frac{5}{5}$ yd., 10 oz., $2\frac{3}{7}$ in.

2. In changing $\frac{7}{4}$ to integers and fractions, think first how many fourths it takes to make one whole unit. Then $\frac{7}{4}$ = how many whole units and $\frac{3}{4}$ remaining?

A fraction whose value is less than 1 is called a **proper fraction**; as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{4}{5}$.

A fraction equal to or greater than one whole unit is called an **improper fraction**; as $\frac{4}{4}$, $\frac{5}{4}$, $1\frac{3}{10}$, $1\frac{2}{5}$.

3. Which of the following fractions are equal to 1? Which are greater than 1? Which are less than one?

$\frac{1}{2}$, $\frac{2}{2}$, $\frac{3}{2}$, $\frac{4}{2}$; $\frac{1}{4}$, $\frac{3}{4}$, $\frac{4}{4}$, $\frac{7}{4}$, $\frac{1}{5}$, $\frac{3}{5}$, $\frac{5}{5}$, $\frac{8}{5}$; $\frac{8}{8}$, $\frac{3}{8}$, $\frac{9}{8}$, $\frac{7}{8}$; $\frac{1}{16}$, $\frac{7}{16}$, $\frac{15}{16}$, $\frac{19}{16}$.

Change to mixed numbers or integers:

4.	$\frac{45}{8}$	**17.**	$\frac{64}{16}$	**30.**	$\frac{100}{16}$ bu.
5.	$\frac{25}{4}$	**18.**	$\frac{96}{12}$	**31.**	$\frac{105}{8}$ oz.
6.	$\frac{87}{9}$	**19.**	$\frac{86}{7}$	**32.**	$\frac{99}{12}$ in.
7.	$\frac{46}{5}$	**20.**	$\frac{69}{7}$	**33.**	$\frac{84}{8}$ mi.
8.	$\frac{29}{8}$	**21.**	$\frac{75}{6}$	**34.**	$\frac{75}{12}$ doz.
9.	$\frac{65}{8}$	**22.**	$\frac{98}{12}$	**35.**	$\frac{75}{7}$ wk.
10.	$\frac{75}{9}$	**23.**	$\frac{148}{12}$	**36.**	$\frac{98}{12}$ rd.
11.	$\frac{65}{7}$	**24.**	$\frac{224}{11}$	**37.**	$\frac{84}{8}$ bu.
12.	$\frac{56}{8}$	**25.**	$\frac{120}{15}$ da.	**38.**	$\frac{110}{9}$ sq. yd.
13.	$\frac{102}{8}$	**26.**	$\frac{49}{5}$ sec.	**39.**	$\frac{116}{10}$ A.
14.	$\frac{79}{7}$	**27.**	$\frac{89}{12}$ hr.	**40.**	$\frac{65}{4}$ lb.
15.	$\frac{45}{3}$	**28.**	$\frac{83}{15}$ min.	**41.**	$\frac{125}{10}$ min.
16.	$\frac{95}{16}$	**29.**	$\frac{87}{8}$ in.	**42.**	$\frac{110}{2}$ oz.

How to cnange whole or mixed numbers to improper fractions

Oral Work

1. Change 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, each to the fractional unit 4ths; to 5ths; to 6ths; to 7ths. Thus, $1 = \frac{4}{4}$, $2 = \frac{8}{4}$, etc

2. Change $1\frac{1}{2}$, $1\frac{3}{4}$, $2\frac{3}{5}$, $3\frac{5}{7}$, $2\frac{7}{8}$, $8\frac{3}{10}$, $9\frac{6}{11}$, $10\frac{5}{12}$, each to the fractional units indicated by the fraction of the mixed numbers. Thus, $1\frac{1}{2} = \frac{3}{2}$.

3. What kind of fractions are $\frac{3}{2}$, $\frac{7}{4}$, $\frac{13}{5}$?

Read as improper fractions:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
4.	$4\frac{3}{4}$	$6\frac{7}{8}$	$2\frac{4}{5}$	$3\frac{3}{8}$	$9\frac{1}{10}$	$4\frac{7}{12}$	$6\frac{3}{8}$	$10\frac{5}{8}$	$9\frac{3}{4}$
5.	$4\frac{2}{3}$	$5\frac{3}{4}$	$5\frac{3}{5}$	$2\frac{5}{12}$	$4\frac{3}{11}$	$2\frac{1}{10}$	$2\frac{1}{4}$	$4\frac{6}{7}$	$5\frac{4}{5}$
6.	$4\frac{3}{8}$	$3\frac{7}{12}$	$9\frac{1}{4}$	$8\frac{5}{6}$	$7\frac{2}{9}$	$9\frac{3}{10}$	$7\frac{5}{12}$	$4\frac{8}{15}$	$6\frac{2}{3}$

Written Work

1. Change $10\frac{7}{16}$ to an improper fraction.

$10\frac{7}{16}$

$\underline{16}$

160 Since 1 unit $= \frac{16}{16}$, 10 units $= 10 \times \frac{16}{16}$, or $\frac{160}{16}$;

$\underline{7}$ $\frac{160}{16} + \frac{7}{16} = \frac{167}{16}$.

167

$\overline{16}$

Change to improper fractions:

2. $15\frac{2}{3}$	**8.** $51\frac{2}{11}$	**14.** $85\frac{5}{16}$	**20.** $42\frac{1}{24}$
3. $17\frac{3}{4}$	**9.** $60\frac{5}{12}$	**15.** $92\frac{2}{3}$	**21.** $71\frac{7}{16}$
4. $18\frac{5}{6}$	**10.** $45\frac{3}{10}$	**16.** $85\frac{7}{12}$	**22.** $83\frac{7}{8}$
5. $25\frac{5}{7}$	**11.** $56\frac{9}{14}$	**17.** $48\frac{19}{20}$	**23.** $65\frac{11}{20}$
6. $35\frac{7}{8}$	**12.** $75\frac{8}{15}$	**18.** $78\frac{3}{16}$	**24.** $28\frac{23}{25}$
7. $42\frac{7}{8}$	**13.** $40\frac{9}{10}$	**19.** $80\frac{11}{50}$	**25.** $47\frac{7}{8}$

How to make fractions similar.

Oral Work

Fractions like $\frac{1}{5}$, $\frac{2}{5}$, and $\frac{4}{5}$, which have the same denominator, are said to have a **common denominator** (c. d.).

Fractions that have a common denominator are called **similar fractions.**

Notice that $\frac{1}{2}$ and $\frac{1}{3}$ may be changed to similar fractions by changing them to fractions having the common denominator, 6, or 12, or 18, or 24, etc.

$$\text{Thus, } \tfrac{1}{2} = \tfrac{3}{6}; \quad \tfrac{1}{3} = \tfrac{2}{6}.$$
$$\text{Or, } \quad \tfrac{1}{2} = \tfrac{6}{12}; \quad \tfrac{1}{3} = \tfrac{4}{12}.$$
$$\text{Or, } \quad \tfrac{1}{2} = \tfrac{9}{18}; \quad \tfrac{1}{3} = \tfrac{6}{18}.$$

1. Is any denominator less than 6 a common denominator of $\frac{1}{2}$ and $\frac{1}{3}$? Then what is the **least common denominator** (l. c. d.) of $\frac{1}{2}$ and $\frac{1}{3}$?

2. Since 4 is the least number that contains 2 and 4, 4 is the least common denominator of $\frac{1}{2}$ and $\frac{1}{4}$. For the same reason, the least common denominator of $\frac{1}{2}$ and $\frac{1}{5}$ is 10 ; of $\frac{1}{4}$ and $\frac{1}{8}$ is 8; of $\frac{2}{3}$ and $\frac{3}{4}$ is 12; of $\frac{3}{5}$ and $\frac{1}{10}$ is 10, etc.

3. Name some common denominators of $\frac{1}{4}$ and $\frac{1}{6}$. Name their least common denominator.

4. What is the least common denominator of $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$: of $\frac{1}{2}$, $\frac{1}{6}$, and $\frac{1}{12}$? What is the least common denominator of $\frac{1}{3}$, $\frac{1}{2}$, and $\frac{1}{9}$? (Notice that 6 is not contained in 9. Hence the least common denominator is 18.)

When you cannot find the l. c. d. by inspection, try multiples of the largest denominator until you find one in which each of the other denominators is exactly contained. Thus, in $\frac{1}{2}$, $\frac{1}{6}$, $\frac{1}{8}$, try 16, 24.

Note. In finding the l. c. d. of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$, the 2 may be ignored, since any multiple of 6 must be a multiple of 2. Similarly, in $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{12}$, the 3 may be ignored; in $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{10}$, the 5 may be ignored, etc.

Find the l. c. d. of fractions with the following denominators.

DENOMINATORS	LEAST COMMON DENOMINATOR	DENOMINATORS	LEAST COMMON DENOMINATOR
5. 3, 5, 10	——	**13.** 4, 3, 12	——
6. 2, 6, 9	——	**14.** 16, 3, 2	——
7. 3, 4, 2	——	**15.** 12, 5, 4	——
8. 3, 9, 6	——	**16.** 14, 2, 7	——
9. 2, 5, 3	——	**17.** 14, 2, 3	——
10. 3, 8, 4	——	**18.** 11, 12	——
11. 3, 9, 15	——	**19.** 3, 7, 9	——
12. 5, 4, 10	——	**20.** 11, 4, 2	——

Change to similar fractions:

21. $\frac{1}{4}, \frac{1}{3}$ **23.** $\frac{1}{2}, \frac{1}{3}$ **25.** $\frac{1}{4}, \frac{1}{12}$ **27.** $\frac{1}{12}, \frac{1}{8}$ **29.** $\frac{1}{6}, \frac{1}{9}$

22. $\frac{1}{4}, \frac{1}{6}$ **24.** $\frac{1}{5}, \frac{1}{4}$ **26.** $\frac{1}{3}, \frac{1}{15}$ **28.** $\frac{1}{8}, \frac{1}{9}$ **30.** $\frac{1}{15}, \frac{1}{6}$

Written Work

1. Change $\frac{3}{4}$, $\frac{7}{10}$, and $\frac{2}{5}$ to similar fractions having the least common denominator.

l. c. d., **20**

$$\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$$
$$\frac{2 \times 4}{5 \times 4} = \frac{8}{20}$$
$$\frac{7 \times 2}{10 \times 2} = \frac{14}{20}$$

You see at once that the l. c. d. is 20.

To change $\frac{3}{4}$ to 20ths, divide the required denominator, 20, by the given denominator, 4.

Multiply both terms by the quotient, 5.

Proceed in the same way with the other fractions.

Change to similar fractions having the l. c. d. :

2. $\frac{5}{8}, \frac{2}{3}$ **8.** $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ **14.** $\frac{9}{16}, \frac{7}{20}, \frac{1}{4}$ **20.** $\frac{5}{12}, \frac{5}{8}, \frac{2}{4}$

3. $\frac{3}{4}, \frac{5}{6}$ **9.** $\frac{1}{6}, \frac{2}{3}, \frac{3}{4}$ **15.** $\frac{5}{9}, \frac{5}{12}, \frac{1}{3}$ **21.** $\frac{1}{12}, \frac{3}{4}, \frac{2}{3}$

4. $\frac{5}{9}, \frac{5}{18}$ **10.** $\frac{1}{2}, \frac{3}{8}, \frac{4}{5}$ **16.** $\frac{5}{6}, \frac{4}{9}, \frac{5}{12}$ **22.** $\frac{1}{20}, \frac{1}{2}, \frac{3}{5}$

5. $\frac{2}{3}, \frac{3}{4}$ **11.** $\frac{3}{8}, \frac{2}{5}, \frac{3}{7}$ **17.** $\frac{3}{10}, \frac{3}{5}, \frac{1}{2}$ **23.** $\frac{6}{7}, \frac{3}{4}, \frac{1}{8}$

6. $\frac{5}{6}, \frac{3}{8}$ **12.** $\frac{7}{8}, \frac{2}{9}, \frac{3}{10}$ **18.** $\frac{5}{16}, \frac{7}{8}, \frac{9}{32}$ **24.** $\frac{8}{9}, \frac{1}{7}, \frac{1}{2}$

7. $\frac{9}{10}, \frac{3}{5}$ **13.** $\frac{5}{12}, \frac{4}{5}, \frac{2}{3}$ **19.** $\frac{3}{16}, \frac{3}{4}, \frac{3}{8}$ **25.** $\frac{5}{6}, \frac{4}{7}, \frac{1}{5}$

ADDITION OF FRACTIONS

Oral Work

1. Can you add $\frac{2}{6}$ and $\frac{1}{6}$? Can you add $\frac{1}{3}$ and $\frac{1}{6}$ without change? What change must be made in $\frac{1}{3}$ and $\frac{1}{6}$ before they can be added? in $\frac{2}{3}$ and $\frac{1}{4}$?

2. $\frac{1}{5} = \frac{?}{10}$; $\frac{2}{5} = \frac{?}{10}$; $\frac{3}{5} = \frac{?}{10}$; $\frac{5}{5} = \frac{?}{10}$.

3. $\frac{1}{2} = \frac{?}{10}$; $\frac{1}{2} + \frac{1}{5} = \frac{?}{10}$; $\frac{1}{2} + \frac{1}{3} = \frac{?}{6}$; $\frac{1}{2} + \frac{1}{8} = \frac{?}{8}$.

4. Can you add $\frac{1}{2}$ and $\frac{1}{5}$ without change? Change both fractions to tenths. Can they then be added?

5. Can you add $\frac{1}{2}$ and $\frac{1}{3}$ without change? Change both fractions to sixths. Can they then be added?

6. When $\frac{1}{2}$ and $\frac{1}{4}$ are to be added, to what similar fractions should they be changed?

7. What are the denominators of the fractions in Ex. 4? To what like or common denominators did you change both fractions?

8. What are the denominators of the fractions in Ex. 5? To what denominator did you change the fraction $\frac{1}{2}$? $\frac{1}{3}$? Why?

9. After two or more fractions are changed to like or common denominators, that is, after they have been made similar, what is the *second step in adding them?*

10. Add $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$.

$\frac{1}{2} + \frac{1}{3} + \frac{1}{6} =$
$\frac{3}{6} + \frac{2}{6} + \frac{1}{6} = \frac{6}{6} = 1.$

11. Add $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{12}$.

$\frac{1}{3} + \frac{1}{4} + \frac{1}{12} =$
$\frac{4}{12} + \frac{3}{12} + \frac{1}{12} = \frac{8}{12} = \frac{2}{3}.$

12. What is the *third step* in adding fractions?

13. What is the total length of two remnants of silk, one $\frac{1}{2}$ yard long, and the other $\frac{7}{8}$ yard long?

Why is the first step not necessary in the following?

14. $\frac{2}{3} + \frac{1}{3}$ **17.** $\frac{1}{5} + \frac{3}{5}$ **20.** $\frac{1}{8} + \frac{3}{8} + \frac{5}{8} + \frac{7}{8}$

15. $\frac{4}{9} + \frac{5}{9}$ **18.** $\frac{3}{7} + \frac{4}{7}$ **21.** $\frac{1}{10} + \frac{3}{10} + \frac{5}{10} + \frac{9}{10}$

16. $\frac{3}{4} + \frac{1}{4}$ **19.** $\frac{5}{6} + \frac{1}{6}$ **22.** $\frac{3}{16} + \frac{5}{16} + \frac{7}{16} + \frac{9}{16}$

Written Work

1. Add $\frac{3}{4}$ and $\frac{5}{9}$.

l. c. d., **36**

$\frac{3 \times 9}{4 \times 9} = \frac{27}{36}$

$\frac{5 \times 4}{9 \times 4} = \frac{20}{36}$

$\frac{3}{4} + \frac{5}{9} = \frac{47}{36}$, or $1\frac{11}{36}$

The l. c. d. of $\frac{3}{4}$ and $\frac{5}{9}$ is 36; $\frac{3}{4} = \frac{27}{36}$ and $\frac{5}{9} = \frac{20}{36}$; $\frac{27}{36} + \frac{20}{36} = \frac{47}{36}$, or $1\frac{11}{36}$.

Observe the three steps in adding fractions:

1. If necessary, make the fractions similar, that is, change them to a common denominator.

2. Write the sum of the numerators over the common denominator.

3. Change the sum to its simplest form.

Add:

2. $\frac{3}{4}, \frac{7}{9}$ **14.** $\frac{2}{15}, \frac{4}{5}, \frac{1}{15}$ **26.** $\frac{2}{3}, \frac{7}{3}, \frac{3}{4}$

3. $\frac{7}{9}, \frac{3}{8}$ **15.** $\frac{9}{10}, \frac{7}{5}, \frac{3}{10}$ **27.** $\frac{4}{5}, \frac{6}{7}, \frac{3}{5}$

4. $\frac{6}{7}, \frac{4}{5}$ **16.** $\frac{2}{3}, \frac{3}{4}, \frac{1}{2}$ **28.** $\frac{2}{7}, \frac{1}{3}, \frac{3}{4}$

5. $\frac{4}{9}, \frac{5}{8}$ **17.** $\frac{2}{3}, \frac{6}{7}, \frac{5}{6}$ **29.** $\frac{4}{9}, \frac{1}{2}, \frac{3}{5}$

6. $\frac{3}{10}, \frac{3}{8}$ **18.** $\frac{6}{7}, \frac{1}{9}, \frac{2}{3}$ **30.** $\frac{7}{8}, \frac{7}{18}, \frac{8}{9}$

7. $\frac{5}{6}, \frac{7}{9}$ **19.** $\frac{3}{4}, \frac{4}{5}, \frac{1}{2}$ **31.** $1\frac{1}{12}, \frac{4}{5}, \frac{9}{10}$

8. $\frac{3}{4}, \frac{7}{5}$ **20.** $\frac{1}{2}, \frac{2}{3}, \frac{3}{5}$ **32.** $\frac{1}{10}, \frac{3}{20}, \frac{4}{5}$

9. $\frac{4}{5}, \frac{3}{10}$ **21.** $\frac{3}{4}, \frac{4}{5}, \frac{5}{6}$ **33.** $\frac{1}{2}, \frac{8}{16}, \frac{7}{8}$

10. $\frac{5}{6}, \frac{4}{5}$ **22.** $\frac{5}{6}, \frac{7}{8}, \frac{8}{10}$ **34.** $\frac{4}{9}, \frac{1}{7}, \frac{1}{8}$

11. $\frac{7}{8}, \frac{5}{16}$ **23.** $\frac{3}{8}, \frac{4}{5}, \frac{1}{2}$ **35.** $\frac{5}{6}, \frac{3}{16}, \frac{1}{2}$

12. $\frac{5}{12}, \frac{5}{16}$ **24.** $\frac{3}{5}, \frac{3}{4}, \frac{1}{2}$ **36.** $\frac{7}{10}, \frac{9}{20}, \frac{5}{8}$

13. $\frac{3}{20}, \frac{4}{5}$ **25.** $\frac{7}{8}, \frac{7}{16}, \frac{3}{4}$ **37.** $\frac{3}{20}, \frac{3}{4}, \frac{3}{10}$

How to add mixed numbers.

Written Work

1. Add $8\frac{2}{3}$ and $12\frac{3}{5}$.

l. c. d., 15

$8\frac{2}{3} = 8\frac{10}{15}$

$12\frac{3}{5} = 12\frac{9}{15}$

$8\frac{2}{3} + 12\frac{3}{5} = 20\frac{19}{15}$, or $21\frac{4}{15}$

The l. c. d. of $\frac{2}{3}$ and $\frac{3}{5}$ is 15.
$\frac{2}{3} = \frac{10}{15}$; $\frac{3}{5} = \frac{9}{15}$. The sum of $\frac{10}{15}$ and $\frac{9}{15}$ is $\frac{19}{15}$, which equals $1\frac{4}{15}$.
The 1 is added to the sum of 12 and 8, making 21, which with $\frac{4}{15}$ makes $21\frac{4}{15}$.

Add:

2. $7\frac{2}{3}$
$8\frac{1}{2}$

3. $150\frac{3}{4}$
$68\frac{5}{8}$

4. $80\frac{5}{6}$
$18\frac{2}{3}$

5. $32\frac{1}{2}$
$60\frac{5}{12}$

6. $175\frac{1}{5}$
$16\frac{1}{2}$

7. $350\frac{7}{12}$
$267\frac{3}{4}$

8. $120\frac{3}{4}$
$261\frac{3}{10}$

9. $135\frac{1}{2}$
$122\frac{4}{15}$

10. $80\frac{1}{4}$
$12\frac{5}{24}$

Add:

11. $1\frac{5}{6} + \frac{3}{8} + 2\frac{7}{8}$

12. $10\frac{8}{9} + 12\frac{2}{3} + 5\frac{7}{12}$

13. $2\frac{5}{12} + 5\frac{3}{4} + 9\frac{4}{15}$

14. $1\frac{3}{4} + 7\frac{4}{5} + 8\frac{7}{8}$

15. $9\frac{3}{5} + 16\frac{7}{10} + 5\frac{14}{15}$

16. $4\frac{7}{8} + \frac{2}{3} + 1\frac{3}{16}$

17. $3\frac{1}{2} + 4\frac{3}{4} + 1\frac{7}{12}$

18. $4\frac{2}{3} + 5\frac{7}{10} + 9\frac{5}{8}$

19. $12\frac{2}{3} + \frac{3}{5} + \frac{7}{8} + 3\frac{9}{10}$

20. $2\frac{2}{9} + 1\frac{1}{6} + 3\frac{1}{4}$

21. A man walked $3\frac{1}{3}$ miles one hour, $3\frac{1}{4}$ miles the second hour, and $2\frac{1}{4}$ miles the third hour. How far did he walk?

22. A farmer sold corn for $\$14\frac{3}{4}$, wheat for $\$37\frac{1}{5}$, and rye for $\$15\frac{1}{10}$. How much did he receive for all?
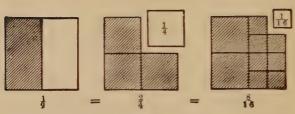
23. Father spent $\$25\frac{1}{2}$ last month for food, $\$16\frac{4}{5}$ for rent, and $\$13\frac{7}{10}$ for clothing. How much did he spend for these three items?

24. Mary sold $2\frac{1}{2}$ yards of lace to one customer, $3\frac{3}{4}$ yards to another, and $5\frac{7}{8}$ yards to a third. What amount did she sell in all?

25. Find the perimeter or distance around a sheet of paper $9\frac{1}{4}$ in. by $5\frac{1}{8}$ in.

26. Helen canned $189\frac{1}{2}$ qt. of fruit, $253\frac{3}{4}$ qt. of vegetables, 15 qt. of soup, $21\frac{1}{2}$ qt. of meat, and $5\frac{3}{4}$ qt. of jellies. What was the total number of quarts she canned?

27. John deposited $\$6\frac{1}{5}$ in a school savings bank, James $\$7\frac{7}{10}$, Henry $\$9\frac{3}{4}$, and Joseph $\$11\frac{1}{2}$. How much did they all deposit?

28. A man bought flour for $\$3\frac{3}{5}$, apples for $\$3\frac{7}{10}$, and sugar for $\$15\frac{3}{4}$. What was the amount of his bill?

29. Four boys got on a scale together. They weighed $90\frac{1}{2}$ pounds, $95\frac{1}{4}$ pounds, $98\frac{7}{8}$ pounds, and $101\frac{9}{16}$ pounds. What was their total weight?

30. A playground was $75\frac{3}{4}$ yards long and $50\frac{7}{8}$ yards wide. Find the distance around the playground.

31. The widths of 4 lots were as follows: $30\frac{1}{2}$ feet, $42\frac{3}{10}$ feet, $38\frac{11}{20}$ feet, and $48\frac{7}{12}$ feet. Find the entire width of the lots.

32. Five floors of an office building were each 12 feet high, two floors were each $13\frac{3}{4}$ feet high, and one floor was $18\frac{5}{6}$ feet high. What was the total height of the eight floors?

33. A vessel sailed $402\frac{7}{8}$ miles the first day, $370\frac{9}{10}$ miles the second day, $325\frac{3}{4}$ miles the third day, and was then $309\frac{1}{2}$ miles from New York. Find how far the ship had sailed when it reached New York.

34. George planted 4 rows of potatoes. The first row produced $5\frac{7}{8}$ bushels; the second, $5\frac{1}{2}$ bushels; the third, $5\frac{3}{4}$ bushels; and the fourth, $4\frac{7}{8}$ bushels. Find the total amount raised in the 4 rows.

35. A man spent $\frac{3}{10}$ of his salary for food, $\frac{1}{5}$ for rent, and $\frac{3}{20}$ for clothing. What fractional part of his salary did he spend for these purposes?

36. A newsboy earned $\$\frac{2}{5}$ one day, $\$\frac{3}{10}$ another day, and $\$\frac{1}{2}$ a third day. How much did he earn in the 3 days?

37. A stick was broken into two pieces — one $3\frac{3}{4}$ ft. long and the other $1\frac{3}{4}$ ft. long. How long was the whole stick?

38. If a man earned $\$3\frac{2}{5}$ a day, and a boy $\$\frac{3}{4}$ a day, how much did the man and the boy earn together in a day?

39. Find the total cost of the following purchases: flour, $\$1\frac{3}{5}$; sugar, $\$\frac{1}{4}$; dried beef, $\$\frac{3}{10}$; and corned beef, $\$\frac{1}{2}$.

40. Anna had some lace for dolls' dresses in four pieces, measuring $1\frac{3}{4}$ yards, $1\frac{3}{4}$ yards, $2\frac{1}{4}$ yards, and $2\frac{1}{2}$ yards. How much lace did she have in all?

41. The rainfall in April was $4\frac{1}{10}$ inches, in May $3\frac{3}{4}$ inches, and in June $4\frac{1}{5}$ inches. What was the total rainfall for the 3 months?

42. A farmer drove first $12\frac{3}{4}$ miles, then $6\frac{7}{8}$ miles, and then $9\frac{1}{2}$ miles. How far did he drive?

43. The feed for a horse cost $\$8\frac{2}{3}$ a month and for a cow, $\$6\frac{3}{4}$ a month. If a man had 2 horses and 2 cows, how much did it cost to feed them a month?

44. Three lengths of ribbon were cut from a piece — the first, $1\frac{3}{4}$ yd. long; the second, $2\frac{1}{8}$ yd. long; and the third, $3\frac{1}{16}$ yd. long. How much ribbon in all was cut from the piece?

SUBTRACTION OF FRACTIONS

Oral Work

$$\tfrac{1}{2} \quad = \quad \tfrac{2}{4} \quad = \quad \tfrac{8}{16}$$

1. 1 sq. in. $-\frac{1}{2}$ sq. in. = —— sq. in.

2. $\frac{1}{2}$ sq. in. $-\frac{1}{4}$ sq. in. = —— sq. in.

3. 1 sq. in. $-\frac{1}{4}$ sq. in. = —— sq. in.

4. $\frac{1}{2}$ sq. in. $-\frac{4}{16}$ sq. in. = —— sq. in.

5. $\frac{1}{2}$ sq. in. $-\frac{1}{16}$ sq. in. = —— sq. in.

6. $\frac{3}{4}-\frac{1}{4}=\frac{?}{4}$; $\frac{5}{8}-\frac{1}{8}=\frac{?}{8}$; $\frac{9}{10}-\frac{3}{10}=\frac{?}{10}$.

7. Give answers to the following: $\frac{11}{12}-\frac{5}{12}=?$ $\frac{11}{18}-\frac{5}{18}=?$ $\frac{5}{11}-\frac{4}{11}=?$ $\frac{19}{20}-\frac{3}{20}=?$ $\frac{24}{25}-\frac{3}{25}=?$

8. What do you notice about the denominators of the fractions you have subtracted in Ex. 7? When the denominators are alike, what do you subtract?

9. Could you subtract $\frac{1}{3}$ from $\frac{1}{2}$ without change? How may these fractions be made similar?

10. When the denominators are *unlike*, what is the *first step*? What is the *second step*? What is the *third step*?

Subtract:

11. $\frac{1}{2}-\frac{1}{4}$	$\frac{1}{2}-\frac{1}{3}$	$\frac{1}{2}-\frac{1}{6}$	$\frac{1}{2}-\frac{1}{6}$	$\frac{1}{2}-\frac{1}{8}$
12. $\frac{1}{3}-\frac{1}{6}$	$\frac{1}{3}-\frac{1}{5}$	$\frac{1}{3}-\frac{1}{12}$	$\frac{1}{3}-\frac{1}{15}$	$\frac{1}{3}-\frac{1}{21}$
13. $\frac{1}{4}-\frac{1}{8}$	$\frac{1}{4}-\frac{1}{3}$	$\frac{1}{4}-\frac{1}{6}$	$\frac{1}{4}-\frac{1}{14}$	$\frac{1}{4}-\frac{1}{14}$

How to subtract fractions or mixed numbers that are not similar.

Written Work

1. From $\frac{3}{4}$ take $\frac{3}{5}$.

l. c. d., 20

$$\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$$

$$\frac{3 \times 4}{5 \times 4} = \frac{12}{20}$$

$$\frac{3}{4} - \frac{3}{5} = \frac{3}{20}$$

The l. c. d. is 20. $\frac{3}{4} = \frac{15}{20}$; $\frac{3}{5} = \frac{12}{20}$; $\frac{15}{20} - \frac{12}{20} = \frac{3}{20}$.

Observe the three steps in subtracting fractions:

1. If necessary, make the fractions similar; that is, reduce them to a common denominator.

2. Subtract the smaller numerator from the greater and write the result over the common denominator.

3. Change the result to its simplest form.

Find the differences:

2. $\frac{2}{3} - \frac{1}{4}$

3. $\frac{3}{4} - \frac{3}{8}$

4. $\frac{5}{6} - \frac{2}{3}$

5. $\frac{7}{10} - \frac{2}{5}$

6. $\frac{5}{6} - \frac{5}{12}$

7. $\frac{3}{8} - \frac{3}{16}$

8. $\frac{5}{6} - \frac{7}{12}$

9. $\frac{4}{5} - \frac{3}{10}$

10. $\frac{7}{9} - \frac{2}{3}$

11. $\frac{3}{8} - \frac{5}{16}$

12. $\frac{2}{5} - \frac{4}{15}$

13. $\frac{3}{4} - \frac{7}{12}$

14. $\frac{7}{8} - \frac{3}{4}$

15. $\frac{7}{8} - \frac{5}{16}$

16. $\frac{2}{3} - \frac{5}{12}$

17. $\frac{3}{4} - \frac{5}{16}$

18. $\frac{5}{6} - \frac{2}{3}$

19. $\frac{5}{6} - \frac{3}{4}$

20. $\frac{7}{8} - \frac{7}{16}$

21. $\frac{11}{12} - \frac{2}{3}$

22. $\frac{9}{16} - \frac{3}{8}$

23. From a piece of cloth containing $\frac{7}{8}$ of a yard, $\frac{3}{4}$ of a yard was sold. What part of a yard remained?

24. John lived $\frac{3}{8}$ mi. from the playground and Peter $\frac{5}{16}$ mi. How much farther did John walk from home to the playground than Peter walked?

25. Mary made a kitchen towel from a piece of linen $\frac{7}{8}$ yd. long. She used $\frac{1}{16}$ yd. for the hems. How long was the towel when hemmed?

26. From 7 take $\frac{2}{3}$.

$$7 = 6\frac{3}{3}$$
$$\frac{2}{3} = \quad \frac{2}{3}$$
$$7 - \frac{2}{3} = 6\frac{1}{3}$$

Change 7 to 6 and $\frac{3}{3}$.
$\frac{3}{3} - \frac{2}{3} = \frac{1}{3}$, which added to $6 = 6\frac{1}{3}$.

Find the differences:

27. $3 - \frac{1}{2}$	**34.** $9 - \frac{5}{6}$	**41.** $25 - \frac{7}{8}$
28. $12 - \frac{2}{3}$	**35.** $3 - \frac{4}{7}$	**42.** $10 - \frac{4}{5}$
29. $22 - \frac{11}{12}$	**36.** $10 - \frac{9}{10}$	**43.** $11 - \frac{3}{4}$
30. $7 - \frac{1}{3}$	**37.** $18 - \frac{14}{15}$	**44.** $40 - \frac{3}{8}$
31. $33 - \frac{8}{9}$	**38.** $28 - \frac{11}{14}$	**45.** $7 - \frac{8}{11}$
32. $44 - \frac{2}{25}$	**39.** $55 - \frac{13}{16}$	**46.** $51 - \frac{7}{10}$
33. $18 - \frac{7}{8}$	**40.** $4 - \frac{19}{20}$	**47.** $48 - \frac{7}{8}$

48. If I had \$2 and spent \$$\frac{4}{5}$, how much had I left?

49. A can contained 8 gallons of oil. After $\frac{7}{8}$ of a gallon was used, how much remained?

50. A grocer who had bought 10 bushels of potatoes, sold $\frac{3}{4}$ of a bushel. How many bushels remained?

51. From $12\frac{3}{4}$ take $10\frac{1}{2}$.

l. c. d., 4
$$12\frac{3}{4} = 12\frac{3}{4}$$
$$10\frac{1}{2} = 10\frac{2}{4}$$
$$12\frac{3}{4} - 10\frac{1}{2} = 2\frac{1}{4}$$

Change $\frac{1}{2}$ to fourths. $\frac{1}{2} = \frac{2}{4}$.
$\frac{3}{4} - \frac{2}{4} = \frac{1}{4}$; $12 - 10 = 2$.
$2 + \frac{1}{4} = 2\frac{1}{4}$.

Find the differences:

52. $4\frac{3}{4} - 3\frac{1}{2}$	**59.** $79\frac{13}{16} - 26\frac{5}{8}$	**66.** $100\frac{1}{3} - 52\frac{1}{2}$
53. $7\frac{2}{3} - 4\frac{1}{2}$	**60.** $97\frac{17}{25} - 35\frac{3}{5}$	**67.** $78\frac{3}{8} - 35\frac{3}{4}$
54. $10\frac{5}{6} - 3\frac{1}{3}$	**61.** $121\frac{3}{4} - 66\frac{2}{5}$	**68.** $50\frac{4}{5} - 40\frac{1}{3}$
55. $10\frac{7}{8} - 2\frac{3}{4}$	**62.** $80\frac{5}{8} - 14\frac{1}{2}$	**69.** $124\frac{5}{11} - 112\frac{1}{4}$
56. $12\frac{7}{9} - 5\frac{3}{8}$	**63.** $98\frac{8}{9} - 32\frac{1}{3}$	**70.** $240\frac{11}{16} - 200\frac{3}{4}$
57. $24\frac{7}{10} - 11\frac{3}{5}$	**64.** $45\frac{11}{36} - 30\frac{1}{4}$	**71.** $15\frac{7}{8} - 8\frac{1}{2}$
58. $31\frac{11}{12} - 18\frac{5}{6}$	**65.** $25\frac{4}{9} - 12\frac{1}{4}$	**72.** $117\frac{3}{4} - 15\frac{5}{8}$

Find the value of:

73. $7\frac{1}{4} - 2\frac{5}{8}$

$$\underline{\text{l. c. d., 8}}$$
$$7\frac{1}{4} = 6\frac{5}{4} = 6\frac{10}{8}$$
$$2\frac{5}{8} = \qquad\quad 2\frac{5}{8}$$
$$\overline{7\frac{1}{4} - 2\frac{5}{8} = 4\frac{5}{8}}$$

Since $\frac{5}{8}$ is greater than $\frac{1}{4}$, change $7\frac{1}{4}$ to $6\frac{5}{4}$. The l. c. d. is 8. $\frac{5}{4} = \frac{10}{8}$. Subtract $2\frac{5}{8}$ from $6\frac{10}{8}$. The remainder is $4\frac{5}{8}$.

74. $3\frac{1}{3} - 1\frac{1}{2}$

75. $5 \ - 2\frac{2}{3}$

76. $5\frac{1}{4} - 2\frac{2}{5}$

77. $10\frac{3}{8} - 5\frac{3}{4}$

78. $20\frac{1}{12} - 13\frac{5}{6}$

79. $50\frac{1}{5} - 30\frac{2}{3}$

80. $6\frac{2}{5} \ - \ 2\frac{3}{7}$

81. $11\frac{3}{5} \ - \ 5\frac{2}{3}$

82. $44\frac{3}{4} - 12\frac{1}{2}$

83. $36\frac{1}{3} - 11\frac{4}{15}$

84. $81\frac{1}{6} - 14\frac{6}{7}$

85. $21\frac{3}{5} - 12\frac{3}{8}$

86. One motorman's trip took $4\frac{2}{5}$ hours, and another's $2\frac{2}{3}$ hours. How much longer was the first trip than the second?

87. A man bought two suits of clothes, one costing $\$35\frac{1}{2}$ and the other $\$28\frac{3}{4}$. How much more did the first suit cost than the second?

88. James lived $1\frac{9}{20}$ miles from the schoolhouse, and Samuel, $1\frac{4}{5}$ miles. How much farther did Samuel have to walk to school than James?

89. A man earned $\$3\frac{2}{5}$ a day, and a boy, $\$\frac{3}{4}$ a day. How much more did the man earn in a day than the boy?

90. A boy was $4\frac{5}{12}$ feet tall. His sister was $3\frac{2}{3}$ feet tall. How much taller was the boy than his sister?

91. The top of a door was $12\frac{1}{2}$ feet above the ground, and the bottom of it was $4\frac{3}{4}$ feet above the ground. How high was the door?

92. From a barrel containing $51\frac{1}{2}$ gallons of oil, $17\frac{1}{2}$ gallons were sold in one day, and $25\frac{1}{2}$ gallons another day. How many gallons remained unsold?

93. A station agent who was paid $\$80$ a month spent in one month $\$12\frac{2}{5}$ for groceries, $\$7\frac{7}{10}$ for meat, and $\$15\frac{1}{4}$ for other expenses. How much did he save?

Review

Find the value of:

1. $\frac{2}{3} + \frac{3}{4} - \frac{5}{6}$

2. $3\frac{1}{2} + 2\frac{1}{4} - 1\frac{5}{8}$

3. $5\frac{1}{3} + 4\frac{5}{6} - 4\frac{5}{12}$

4. $1\frac{5}{8} + 2\frac{1}{12} - 1\frac{5}{6}$

5. $9\frac{3}{5} - 4\frac{2}{5} + 3\frac{7}{10}$

6. $12\frac{3}{4} - 5\frac{1}{2} + 2\frac{2}{9}$

7. $\frac{3}{4} - \frac{1}{2} + \frac{7}{8} + \frac{5}{16}$

8. $20 + \frac{1}{16} + \frac{1}{12} - 2\frac{1}{4}$

9. $\frac{1}{3} + \frac{1}{4} + \frac{5}{6} - \frac{7}{12}$

10. $17\frac{11}{24} - 10\frac{3}{8} + 5\frac{1}{3} + 2\frac{5}{6}$

11. $15 - 2\frac{2}{3} + 4\frac{1}{5}$

12. $40\frac{1}{4} + 60\frac{1}{3} + 30\frac{11}{16}$

13. $19\frac{7}{32} - 11\frac{5}{8} + 1\frac{5}{16}$

14. $7\frac{7}{9} + 4\frac{1}{3} + 11\frac{5}{12}$

15. $3\frac{5}{12} + 9\frac{5}{9} - 7\frac{1}{6}$

16. $21\frac{7}{12} + 7\frac{1}{3} - 20\frac{1}{4}$

17. $8\frac{3}{4} + 22\frac{2}{5} + 43\frac{3}{8}$

18. $225\frac{3}{8} + 132\frac{5}{12} + 80\frac{17}{20}$

19. $12\frac{2}{3} + 19\frac{7}{3} - 27\frac{5}{6}$

20. $19\frac{1}{5} + 11\frac{3}{8} + 14\frac{1}{4}$

21. Arthur bought a hat and gave in payment $10. If he received in change $7\frac{3}{4}$, how much did the hat cost?

22. The treasurer of a literary society received $492\frac{1}{2}$. He spent for light and heat $50\frac{3}{4}$, for new books $77\frac{1}{4}$, for a lecturer's expenses $26\frac{1}{2}$, and for music for an entertainment $80. How much remained in his hands?

23. A teacher's salary was $95 a month. One month he spent $30 for board, $9\frac{1}{2}$ for a room, $9\frac{3}{5}$ for clothes, and $10\frac{1}{10}$ for other expenses. How much did he save?

24. A dealer bought $61\frac{3}{4}$ bushels of apples from one man, $127\frac{1}{2}$ bushels from another, and $89\frac{3}{4}$ bushels from another. How much did they cost at $1.50 a bushel?

25. A student spent $\frac{1}{4}$ of the day in study, $\frac{1}{6}$ in recitations, $\frac{1}{12}$ at his meals, and $\frac{1}{8}$ in recreation and exercise. What part of the day had he left for sleep?

26. A boy walked around a field $60\frac{1}{2}$ rods long and 40 rods wide. How far did he walk?

27. John raised $45\frac{1}{2}$ bushels of corn and Hugh raised $37\frac{4}{5}$ bushels. How much more did John raise than Hugh?

28. Helen timed herself in knitting a sock. It took her $1\frac{1}{3}$ hours to purl the top, $2\frac{1}{2}$ hours for the leg, $1\frac{1}{4}$ hours for the heel, $2\frac{3}{8}$ hours for the foot and toe. How long did it take her to finish the sock?

29. A clerk earned $80 a month and spent for board $33\frac{1}{2}$, for clothes $15\frac{3}{4}$, and for other expenses $16\frac{4}{5}$. How much of his month's salary did he save?

30. From a piece of ribbon containing 10 yards were sold $\frac{1}{2}$ of a yard, $1\frac{1}{4}$ yards, $\frac{3}{4}$ of a yard, $\frac{5}{8}$ of a yard, $2\frac{3}{4}$ yards, and 3 yards. How many yards remained unsold?

31. A mail carrier worked 8 hours a day. In making three deliveries he worked $1\frac{1}{6}$ hours, $2\frac{1}{3}$ hours, and $2\frac{3}{4}$ hours. How much time had he for a fourth delivery?

32. Paul raised $24\frac{1}{2}$ tons of sugar beets and Frank raised $20\frac{4}{5}$ tons. How much more did Paul raise than Frank?

33. Alfred caught 3 fish. The first weighed $\frac{1}{2}$ of a pound, the second $\frac{7}{8}$ of a pound, and the third $1\frac{1}{4}$ pounds. How much did the three fish weigh together?

34. A real estate agent bought $16\frac{1}{2}$ acres of land. He sold $2\frac{1}{4}$ acres to one man and $5\frac{7}{8}$ acres to another man. How many acres had he remaining?

35. The sum of two fractions is $\frac{7}{8}$ and one of the fractions is $\frac{2}{5}$. What is the other fraction?

36. A dairyman sold milk as follows: Monday, $65\frac{3}{8}$ gallons; Tuesday, $60\frac{1}{2}$ gallons; Wednesday, $71\frac{3}{4}$ gallons; Thursday, 69 gallons; Friday, $67\frac{7}{8}$ gallons; and Saturday, $90\frac{1}{4}$ gallons. What were his total sales for the week?

37. A salesman traveled in 4 days as follows: Monday, $122\frac{1}{2}$ miles; Tuesday, $187\frac{3}{4}$ miles; Wednesday, $93\frac{1}{8}$ miles; and Thursday, $207\frac{3}{16}$ miles. How many miles did he travel in all?

38. If a boat will safely carry 800 pounds, how many pounds of provisions can be carried when three men, whose weights are $165\frac{1}{2}$ pounds, $182\frac{3}{4}$ pounds, and 208 pounds, are in the boat?

39. In 3 days in June the sun shone in New York $14\frac{4}{5}$ hours, $14\frac{3}{20}$ hours, and $14\frac{19}{30}$ hours. How many hours of sunshine were there in these 3 days? How many hours without sunshine were there?

40. Raymond walked $1\frac{7}{8}$ miles to school, and George walked $\frac{2}{3}$ of a mile. How far did they both walk, and how much farther did Raymond walk than George?

41. A playground was $16\frac{1}{3}$ yards wide and $25\frac{3}{3}$ yards long. Find the distance around it. How much greater was the playground in length than in width?

42. Measure the distance around your school ground in feet and fractions of a foot; then in yards and fractions of a yard; then secure a tape line and measure it in rods and fractions of a rod. Find its *perimeter* in each of these three units of measure.

43. With a yardstick let each pupil measure in feet and fractions of a foot the length and the width of the different rooms in each one's house, first finding the perimeter of each room, and then the difference between the length and the width of each room.

44. The rainfall in three different months was as follows: $3\frac{7}{10}$ inches, $4\frac{2}{5}$ inches, and $2\frac{3}{10}$ inches. Find the rainfall for the three months, and the difference between the greatest rainfall and the rainfall for each of the other months.

45. A baby gained 2 ounces the first week, 3 ounces the second week, 4 ounces the third week, and 8 ounces the fourth week. Express each week's gain as a part of a pound and find how many pounds the baby gained in four weeks.

46. Make up two problems involving addition and subtraction of fractions, and two involving addition and subtraction of mixed numbers.

47. A western farmer sold three loads of alfalfa in one summer. The first weighed $2\frac{3}{4}$ tons; the second, $2\frac{7}{8}$ tons; and the third, $1\frac{3}{4}$ tons. Find the entire number of tons sold.

48. Hugh's father cut ice on his mill pond three times during the winter. The first cutting was $6\frac{5}{8}$ inches, the second cutting was $8\frac{3}{4}$ inches, and the third cutting was $5\frac{9}{16}$ inches. Find the entire thickness of the ice for the three cuttings.

49. In problem 48 find the difference between the greatest thickness and each of the other two thicknesses.

50. Arthur is 4 feet 8 inches tall, and Ada is 3 feet 9 inches tall. Express their heights in feet as mixed numbers. How much taller is Arthur than Ada?

51. The weather department reported $3\frac{1}{3}$ hours sunshine on Monday, $2\frac{2}{3}$ hours sunshine on Tuesday, and $5\frac{1}{4}$ hours sunshine on Wednesday. Find the total time of sunshine for the three days.

52. Robert ran 100 yards in $9\frac{3}{10}$ seconds and George ran the same distance in $11\frac{3}{4}$ seconds. By how much did Robert beat George's time?

53. Edward weighs 70 pounds 8 ounces and James weighs 98 pounds 4 ounces. Express their weights as mixed numbers and find the sum and the difference of their weights.

54. Jean grew $\frac{3}{4}$ of an inch in three months, Paul grew $\frac{5}{8}$ of an inch, and Susan grew $\frac{5}{16}$ of an inch. Express the difference between Jean's growth and each of the other two.

55. James worked $6\frac{3}{4}$ hours after school in one week, Henry worked $4\frac{4}{5}$ hours, and Frank worked $2\frac{1}{2}$ hours. Find the number of hours the three boys were employed during the week.

56. Mary's hair ribbon contained $\frac{3}{4}$ of a yard; Ruth's hair ribbon contained $\frac{7}{8}$ of a yard; and Martha's sash contained $2\frac{1}{2}$ yards. How many yards of ribbon were there in all three pieces?

57. John is $7\frac{3}{4}$ years old, and his father is 30 years and 6 months old. How much older is John's father than John?

58. If a rug is $6\frac{2}{3}$ feet long and $4\frac{5}{12}$ feet wide, what is the difference between its length and its width?

59. Mary bought three remnants of ribbon. The first was $3\frac{3}{4}$ yards; the second, $\frac{7}{8}$ of a yard; and the third, $2\frac{1}{16}$ yards. How much ribbon did Mary buy?

60. Three boys rowed $8\frac{1}{4}$ miles from their camp to the village. Martin rowed $3\frac{5}{16}$ miles and Frank rowed $1\frac{5}{8}$ miles. How far did Howard row?

First add each number in a to the numbers on the same line in b, c, d, e, f, g. Thus, in 61, add $2\frac{4}{5}$, first to $3\frac{5}{8}$, then to $4\frac{3}{4}$, then to $8\frac{2}{3}$, etc. In 62 add $4\frac{3}{8}$, first to $6\frac{2}{9}$, then to $5\frac{2}{7}$, etc. Then subtract each number in column a from the numbers on the same line in b, c, d, e, f, g. Thus, in 61, subtract $2\frac{4}{5}$, first from $3\frac{5}{8}$, then from $4\frac{3}{4}$, then from $8\frac{2}{3}$, etc. In 62 subtract $4\frac{3}{8}$, first from $6\frac{2}{9}$, then from $5\frac{2}{7}$, etc.

	a	b	c	d	e	f	g
61.	$2\frac{4}{5}$	$3\frac{5}{8}$	$4\frac{3}{4}$	$8\frac{2}{3}$	$5\frac{1}{2}$	$7\frac{3}{4}$	$9\frac{2}{3}$
62.	$4\frac{3}{8}$	$6\frac{2}{9}$	$5\frac{2}{7}$	$5\frac{1}{3}$	$8\frac{4}{9}$	$9\frac{2}{3}$	$9\frac{1}{4}$
63.	$8\frac{3}{10}$	$11\frac{4}{5}$	$12\frac{7}{10}$	$15\frac{4}{7}$	$22\frac{5}{12}$	$32\frac{5}{16}$	$25\frac{11}{12}$
64.	$9\frac{1}{4}$	$40\frac{5}{8}$	$45\frac{3}{16}$	$48\frac{9}{10}$	$14\frac{3}{10}$	$60\frac{5}{8}$	$65\frac{4}{16}$
65.	$8\frac{1}{10}$	$75\frac{1}{5}$	$80\frac{5}{18}$	$59\frac{3}{16}$	$77\frac{3}{8}$	$68\frac{5}{9}$	$98\frac{4}{12}$

SPEED TESTS

Time yourself in these examples.
Then work them again and try to improve your record.

Oral Work

Add:

	a	b	c	d	e	f	g	h	i	j
1.	$\frac{5}{8}$	$\frac{1}{6}$	$\frac{9}{10}$	$\frac{8}{9}$	$\frac{11}{15}$	$\frac{9}{10}$	$\frac{12}{13}$	$\frac{7}{11}$	$\frac{9}{14}$	$\frac{9}{16}$
	$\frac{7}{8}$	$\frac{5}{6}$	$\frac{3}{10}$	$\frac{4}{9}$	$\frac{14}{15}$	$\frac{7}{10}$	$\frac{10}{13}$	$\frac{9}{11}$	$\frac{8}{14}$	$\frac{13}{16}$
2.	$\frac{4}{5}$	$\frac{3}{10}$	$\frac{3}{20}$	$\frac{2}{25}$	$\frac{7}{15}$	$\frac{7}{9}$	$\frac{6}{7}$	$\frac{5}{12}$	$\frac{5}{13}$	$\frac{15}{16}$
	$\frac{3}{5}$	$\frac{7}{10}$	$\frac{7}{20}$	$\frac{3}{25}$	$\frac{8}{15}$	$\frac{8}{9}$	$\frac{5}{7}$	$\frac{11}{12}$	$\frac{9}{13}$	$\frac{11}{16}$

Written Work

Add:

1. $3\frac{2}{5}$ 4. $6\frac{1}{5}$ 7. $3\frac{2}{9}$ 10. $3\frac{1}{2}$ 13. $4\frac{1}{8}$
   $5\frac{3}{4}$ $7\frac{2}{3}$ $5\frac{1}{3}$ $8\frac{3}{4}$ $5\frac{2}{7}$

2. $3\frac{4}{5}$ 5. $7\frac{3}{8}$ 8. $6\frac{5}{9}$ 11. $12\frac{1}{3}$ 14. $7\frac{7}{8}$
   $2\frac{3}{10}$ $4\frac{1}{12}$ $2\frac{5}{12}$ $15\frac{3}{4}$ $2\frac{1}{2}$

3. $25\frac{3}{5}$ 6. $63\frac{7}{12}$ 9. $61\frac{5}{8}$ 12. $98\frac{3}{16}$ 15. $6\frac{7}{8}$
   $21\frac{3}{10}$ $50\frac{3}{10}$ $27\frac{4}{8}$ $15\frac{11}{24}$ $3\frac{3}{16}$

Subtract, and test results by adding:

16. $24\frac{3}{4}$ 18. $40\frac{3}{8}$ 20. $44\frac{7}{8}$ 22. $14\frac{11}{12}$ 24. $27\frac{5}{8}$
    $14\frac{1}{2}$ $12\frac{1}{10}$ $29\frac{3}{4}$ $9\frac{3}{10}$ $19\frac{7}{16}$

17. $91\frac{13}{16}$ 19. $36\frac{8}{9}$ 21. $15\frac{3}{5}$ 23. $40\frac{7}{8}$ 25. $18\frac{7}{12}$
    $47\frac{1}{4}$ $18\frac{2}{3}$ $9\frac{1}{10}$ $20\frac{3}{16}$ $11\frac{1}{3}$

MULTIPLICATION OF FRACTIONS

How to find the product of a fraction by a whole number.

Oral Work

3 feet = 1 yard

1. What is $\frac{1}{2}$ of $2?

2. Two times $\$\frac{1}{2}$ = —— dollar.

Notice that $\frac{1}{2}$ of $2 = 2 \times \$\frac{1}{2}$.

3. Into how many halves is the square divided? Two times $\frac{1}{2}$ a square = —— square.

4. Into how many halves is the circle divided? Two times $\frac{1}{2}$ a circle = —— circle.

5. What is $\frac{1}{3}$ of 3 feet? $\frac{1}{3}$ of 3 = ?

6. How much is 3 times $\frac{1}{3}$ of a yard?

7. $\frac{1}{2}$ of $5 = ? \quad 5 \times \$\frac{1}{2} = ?$

Notice that $\frac{1}{2}$ of $5 = 5 \times \$\frac{1}{2}$.

8. $2 \times \frac{1}{3}$ of a yard = —— yard.

9. $\frac{2}{3}$ of 1 yard = —— yard.

10. $6 \times \frac{1}{3}$ of a yard = —— yards.

11. $\frac{1}{3}$ of 6 yards = —— yards.

12. $6 \times \frac{1}{2}$ of a circle = —— circles.

13. $\frac{1}{2}$ of 6 circles = —— circles.

14. $12 \times \frac{1}{2}$ of a circle = —— circles.

15. $\frac{1}{2}$ of 12 circles = —— circles.

16. $4 \times \frac{1}{2}$ is the same as $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$.

17. $6 \times \frac{1}{2} = \frac{6}{2}$, or 3.

Give the products:

18. $8 \times \frac{1}{2}$	**23.** $9 \times \frac{2}{3}$	**28.** $7 \times \frac{4}{9}$	**33.** $3 \times \frac{1}{11}$
19. $12 \times \frac{1}{4}$	**24.** $8 \times \frac{3}{4}$	**29.** $12 \times \frac{8}{9}$	**34.** $12 \times \frac{4}{7}$
20. $6 \times \frac{2}{3}$	**25.** $9 \times \frac{9}{10}$	**30.** $4 \times \frac{7}{11}$	**35.** $5 \times \frac{7}{8}$
21. $7 \times \frac{3}{7}$	**26.** $6 \times \frac{4}{5}$	**31.** $8 \times \frac{3}{7}$	**36.** $6 \times \frac{4}{5}$
22. $10 \times \frac{3}{5}$	**27.** $8 \times \frac{8}{9}$	**32.** $11 \times \frac{7}{8}$	**37.** $6 \times \frac{8}{9}$

38. When you multiply $\frac{3}{4}$ by 8, which number is the multiplier? Which number is the multiplicand?

You have learned that you may divide a unit into equal parts and then take any number of these parts. Thus, $\frac{3}{4}$ of $8 means that $8 (8 units) is divided into 4 equal parts of $2 each and that 3 of these parts, or $6, are taken.

Notice that $\frac{3}{4}$ of $8 = 8 \times \frac{3}{4}$.

39. If the sign of multiplication is written after a fractional multiplier, it may be read "of." Thus, $\frac{3}{4} \times 12$ may be read "$\frac{3}{4}$ of 12." Read: $\frac{2}{3} \times 9$; $\frac{3}{4} \times 6$; $\frac{7}{8} \times 4$; $\frac{3}{5} \times 10$.

Find the following:

40. $\frac{3}{4}$ of $24	**44.** $\frac{5}{9}$ of 36 minutes	**48.** $\frac{7}{9}$ of 72 cents
41. $\frac{9}{10}$ of 60 horses	**45.** $\frac{11}{12}$ of $144	**49.** $\frac{9}{11}$ of 99
42. $\frac{2}{3}$ of 36 days	**46.** $\frac{6}{13}$ of 78 miles	**50.** $\frac{4}{15}$ of 75
43. $\frac{4}{5}$ of 20 hours	**47.** $\frac{5}{11}$ of 44 rods	**51.** $\frac{3}{7}$ of 84
52. Find $\frac{2}{3}$ of 4.		

SOLUTION. $\frac{1}{3}$ of $4 = \frac{4}{3}$, and $\frac{2}{3}$ of $4 = 2 \times \frac{4}{3}$, or $\frac{8}{3}$; $\frac{8}{3} = 2\frac{2}{3}$.

Find the following:

53. $\frac{2}{5}$ of 7	**59.** $\frac{9}{10}$ of 12	**65.** $\frac{2}{7}$ of 20
54. $\frac{3}{4}$ of 9	**60.** $\frac{11}{15}$ of 8	**66.** $\frac{3}{7}$ of 6
55. $\frac{7}{8}$ of 12	**61.** $\frac{7}{11}$ of 8	**67.** $\frac{4}{5}$ of 9
56. $\frac{5}{9}$ of 8	**62.** $\frac{3}{5}$ of 9	**68.** $\frac{3}{8}$ of 11
57. $\frac{6}{7}$ of 10	**63.** $\frac{4}{11}$ of 12	**69.** $\frac{7}{9}$ of 10
58. $\frac{4}{5}$ of 3	**64.** $\frac{7}{8}$ of 7	**70.** $\frac{5}{8}$ of 12

Written Work

1. Find the cost of $\frac{7}{8}$ yard of silk at $2 a yard.

2. The freight on a ton of merchandise was 56 cents. What was the freight charge for $\frac{5}{8}$ of a ton?

3. Find the cost of $\frac{3}{4}$ of a dozen buttons at $1.28 a dozen.

4. A workman earned $4 a day. How much did he earn in $\frac{5}{8}$ of a day?

5. At 42 miles an hour, how far did an automobile travel in $\frac{2}{3}$ of an hour?

6. A merchant owing $1236 gave his check for $\frac{3}{4}$ of the amount. For how much did he write his check?

7. Mr. Rice owned a tract of land containing 2500 acres. He sold $\frac{2}{5}$ of it to Mr. Brown and $\frac{1}{3}$ of the remainder to Mr. Thomas. How much did he sell to each?

8. If a laborer worked $\frac{4}{5}$ of the days in a common year, how many days did he work?

9. A student's expenses at college were $720 a year. If board and tuition cost $\frac{2}{3}$ of that amount, how much did the other expenses amount to?

10. A contractor agreed to erect a building for $24,570. Labor cost $\frac{1}{3}$ of the amount, material $\frac{2}{3}$ of the remainder. Find his profit.

11. $\frac{5}{8}$ of the entire enrollment of 14,720 in school were girls. Find the number of girls and the number of boys.

12. A man whose income was $960 spent $\frac{2}{3}$ of this amount for a year's rent. Find the monthly rent bill.

13. An automobile cost $3456 and the expenses and repairs for one year were $\frac{3}{16}$ of the cost. Find the expenses.

14. A farmer bought a farm of 160 acres at $25 an acre. He erected a house costing $\frac{2}{5}$ as much as the land, and a barn costing $\frac{1}{2}$ as much as the house. Find the total cost of the property.

How to multiply a mixed number by a whole number or a whole number by a mixed number.

Oral Work

1. Find the cost of $2\frac{3}{4}$ pounds of butter at 48 cents a pound.

2. I bought $4\frac{7}{8}$ yards of ribbon at 40 cents a yard. How much did it cost?

3. A boy scout walked 3 miles in an hour. How far did he walk at the same rate in $2\frac{2}{3}$ hours?

4. Kate sold a customer $2\frac{3}{8}$ yd. ribbon @ 16 cents and $1\frac{1}{4}$ yd. lace @ 40 cents. What was the total of the sales slip?

5. How much did $5\frac{3}{8}$ pounds of fish cost at 24 cents a pound?

6. A man bought $7\frac{1}{2}$ gallons of oil at 12 cents a gallon. How much did he pay for it?

7. Natural gas costs 25 cents a thousand feet. Find the cost of $10\frac{2}{5}$ thousand feet.

8. If a lot cost $200 and a house $8\frac{1}{8}$ times as much, how much did the house cost?

9. Ida worked on a farm $20\frac{3}{4}$ days in a month for $2 a day. How much did she earn?

10. How many inches equal $9\frac{3}{4}$ feet?

11. At 80 cents a bushel, find the cost of $2\frac{1}{2}$ bushels of oats.

12. Walter bought $1\frac{3}{4}$ dozen collars at $2 a dozen. How much did they cost him?

13. At 12 cents a pound find the cost of $15\frac{3}{4}$ pounds of raisins.

14. How much did $5\frac{7}{8}$ yards of cloth cost at $2 a yard?

15. A workman earned 75 cents an hour. How much did he receive in $3\frac{2}{5}$ hours?

16. How far did an automobile travel in $2\frac{1}{2}$ hours at 18 miles an hour?

17. The freight on a ton of merchandise was 32 cents. How much was it for the same distance on $5\frac{3}{8}$ tons?

18. A gallon of water weighs 8 pounds. How much do $10\frac{3}{4}$ gallons weigh?

19. Find the cost of 6 eggs at $4\frac{1}{2}$ cents apiece.

20. Find the cost of 4 quarts of oil at $4\frac{1}{2}$ cents a quart.

21. Find the cost of 8 pounds of rice at $8\frac{1}{4}$ cents a pound.

22. Find the cost of 12 pounds of sugar at $9\frac{1}{3}$ cents a pound.

23. Find the cost of 6 boxes of berries at $8\frac{1}{2}$ cents a box.

24. A boy earned $1\frac{1}{4} a day. How much did he earn in 6 days?

25. When apples sold for $1\frac{1}{4} a bushel, find the cost of 8 bushels.

26. Mary paid $1\frac{3}{4} for music lessons and took two lessons a week. How much did her music lessons cost her in 4 weeks?

27. Find the cost of 24 yards of silk at $1\frac{3}{8} a yard.

28. We paid $15\frac{1}{2}$¢ a quart for milk. How much was our milk bill in a week, if we used 2 quarts a day?

29. By buying 25 cents worth of street car tickets, each ticket cost me $4\frac{1}{6}$ cents. Find the cost of 12 tickets.

30. A storekeeper made $1\frac{2}{3}$ cents on each can of corn. How much did he make on 18 cans?

31. A train averaging $30\frac{1}{2}$ miles an hour took 8 hours to go from Dare to Eden. What is the distance between these towns?

32. Mary used $1\frac{2}{3}$ yards of ribbon for a bow. How much did it take for 9 such bows?

33. Find the cost of a dozen eggs at $4\frac{1}{3}$ cents apiece.

34. 3 pounds of prunes cost 45 cents. How much did 12 pounds cost?

Suggestion. 12 pounds cost how many times the cost of 3 pounds?

Written Work

1. Multiply 18 by $14\frac{2}{3}$.

18

$14\frac{2}{3}$

$12 = \frac{2}{3}$ of 18 $14\frac{2}{3}$ times 18 means that $\frac{2}{3}$ of 18 is to be added

72   to 14×18.

18        $\frac{2}{3}$ of $18 = 12$, which added to $14 \times 18 = 264$.

264

2. Find $25 \times 32\frac{2}{3}$.

$32\frac{2}{3}$

25

$\frac{50}{3} = 16\frac{2}{3}$ This means that $25 \times \frac{2}{3}$ is to be added to 25×32.

160    $25 \times \frac{2}{3} = \frac{50}{3}$, or $16\frac{2}{3}$, which added to $25 \times 32 = 816\frac{2}{3}$.

64

$816\frac{2}{3}$

Find the products :

3. $7\frac{1}{2} \times 6$	**10.** $100\frac{1}{10} \times 60$	**17.** $8 \times 4\frac{1}{2}$
4. $15\frac{1}{3} \times 9$	**11.** $95\frac{1}{5} \times 45$	**18.** $10 \times 4\frac{1}{2}$
5. $27\frac{1}{6} \times 12$	**12.** $81\frac{1}{7} \times 21$	**19.** $9 \times 2\frac{2}{3}$
6. $120\frac{1}{8} \times 40$	**13.** $120\frac{1}{9} \times 81$	**20.** $12 \times 3\frac{3}{4}$
7. $216\frac{1}{10} \times 50$	**14.** $144\frac{1}{2} \times 108$	**21.** $11 \times 3\frac{3}{11}$
8. $73\frac{1}{3} \times 15$	**15.** $150\frac{1}{15} \times 60$	**22.** $14 \times 2\frac{2}{7}$
9. $140\frac{1}{4} \times 28$	**16.** $180\frac{1}{18} \times 18$	**23.** $12 \times 8\frac{1}{2}$

24. $6 \times 8\frac{1}{2}$

25. $5 \times 3\frac{3}{5}$

26. $10 \times 2\frac{2}{3}$

27. $12 \times 3\frac{2}{5}$

28. $20 \times 5\frac{2}{5}$

29. $45 \times 12\frac{7}{8}$

30. $120 \times 22\frac{3}{8}$

31. $154 \times 11\frac{6}{7}$

32. $96 \times 6\frac{2}{8}$

33. $144 \times 9\frac{1}{6}$

34. $80 \times 4\frac{5}{16}$

35. $125 \times 18\frac{3}{4}$

36. $72 \times 24\frac{5}{7}$

37. $100 \times 14\frac{7}{10}$

38. $132 \times 5\frac{5}{8}$

39. $168 \times 10\frac{5}{11}$

40. $20 \times 18\frac{4}{5}$

41. $90 \times 15\frac{5}{6}$

42. $50 \times 16\frac{1}{4}$

43. $200 \times 15\frac{3}{20}$

44. $20\frac{1}{20} \times 100$

45. $42\frac{1}{11} \times 55$

46. $64\frac{1}{13} \times 39$

47. $72\frac{1}{14} \times 42$

48. $102\frac{1}{16} \times 80$

49. $125\frac{1}{24} \times 120$

50. $12\frac{2}{3} \times 9$

51. $14\frac{3}{5} \times 10$

52. $20\frac{3}{4} \times 12$

53. $35\frac{5}{6} \times 18$

54. $95\frac{1}{7} \times 42$

55. $100\frac{3}{5} \times 20$

56. $124\frac{5}{6} \times 120$

57. $65\frac{3}{8} \times 32$

58. $116\frac{2}{9} \times 54$

59. $112\frac{3}{10} \times 50$

60. $88\frac{3}{7} \times 28$

61. $30\frac{5}{8} \times 160$

62. $19\frac{7}{12} \times 24$

63. $3\frac{7}{15} \times 60$

64. $145\frac{3}{11} \times 55$

65. $48\frac{6}{7} \times 84$

66. $21\frac{3}{4} \times 16$

67. $40\frac{1}{2} \times 25$

68. $121\frac{6}{7} \times 49$

69. $10\frac{8}{9} \times 18$

70. $14\frac{7}{8} \times 24$

71. $20\frac{1}{12} \times 84$

72. A book dealer purchases 125 books at wholesale at $1\frac{1}{5}$ each. Find the cost.

73. The fare between two cities on the Ft. Wayne R.R. is $10\frac{1}{2}$. Find the amount received from the sale of 50 tickets.

74. A newsdealer buys 300 papers at $1\frac{1}{4}$ cents each and sells them at 2 cents each. Find the cost and the gain.

75. A fruit dealer buys a barrel of apples for $4\frac{1}{2}$. The barrel contains 360 apples. He sells one half of them at the rate of 2 for 5 cents and the remainder at the rate of 3 for 5 cents. Find his profit.

SUGGESTION. At 2 for 5¢, 180 apples cost 90×5¢; at 3 for 5¢, 180 apples cost 60×5¢.

76. Find the cost of $16\frac{1}{2}$ yd. of cloth at $1.50 a yard.

The seller usually regards any part of a cent as an additional cent.

77. A clerk sold a customer $3\frac{1}{2}$ yd. serge @ $3.45, $2\frac{1}{4}$ yd. silk @ $1.75, and $4\frac{3}{8}$ yd. trimming @ $.95. Find the amount of the sales slip.

78. Find the total cost of $6\frac{3}{4}$ lb. fish @ 28 ¢ and a $3\frac{1}{4}$-pound chicken @ 48 ¢.

79. A clerk sold $5\frac{3}{8}$ yd. lace @ 40 ¢, $2\frac{5}{8}$ yd. ribbon @ 25 ¢, and $1\frac{1}{7}$ doz. buttons @ 85 ¢. Find the total of the sales slip.

80. How much change should I receive from $15 if I bought $3\frac{1}{8}$ yd. serge @ $2.50, $1\frac{7}{8}$ yd. silk @ $1.98, and $2\frac{1}{2}$ yd. lining @ $.25?

81. An airplane averaged $2\frac{5}{12}$ mi. a minute in a trial flight. How many miles an hour was this?

82. If the rate of sailing of a vessel was 18 mi. an hour, how far did it sail in $24\frac{1}{3}$ hr.?

83. A grocer bought 20 doz. lemons @ 25 ¢ and sold them at the rate of $2\frac{1}{2}$ ¢ each. Find the gain.

84. At $3\frac{2}{5}$ ¢ a pound find the cost of a bushel (60 lb.) of potatoes.

85. At $6\frac{1}{3}$ ¢ a pound find the cost of 15 lb. of rolled oats.

86. When pea beans are $12\frac{1}{2}$ ¢ a pound how much must be paid for 24 lb.?

87. Find the total amount paid for 10 lb. coffee @ $28\frac{1}{4}$ ¢, 4 lb. tea @ $32\frac{1}{2}$ ¢, 8 lb. rice @ $10\frac{3}{4}$ ¢.

88. Find the total amount paid for $2\frac{5}{8}$ yd. silk @ $1.75, $3\frac{3}{4}$ yd. lace @ $1.50, and $2\frac{3}{4}$ doz. buttons @ 85 ¢.

89. If a train averages $30\frac{3}{4}$ mi. an hour, how far will it run in 18 hr.?

90. How much change should Alice get from $5 if she bought $3\frac{3}{8}$ yd. of ribbon @ 24 ¢ and $2\frac{3}{4}$ yd. of cretonne @ 56 ¢?

How to multiply a fraction by a fraction.

Oral and Written Work

1. What is $\frac{1}{2}$ of $\frac{1}{2}$ of a circle? $\frac{1}{4}$ of $\frac{1}{2}$ of a circle?

2. Show by a drawing what is meant by $\frac{1}{4}$ of $\frac{1}{3}$ of a square; by $\frac{1}{4}$ of $\frac{2}{3}$ of a square.

3. What is $\frac{1}{3}$ of 3 feet? $\frac{2}{3}$ of 3 feet?

4. What is $\frac{1}{3}$ of 3 fifths? $\frac{2}{3}$ of 3 fifths?

SOLUTION. $\frac{1}{3}$ of $\frac{3}{5} = \frac{1}{5}$; hence $\frac{2}{3}$ of $\frac{3}{5} = 2$ times $\frac{1}{5}$, or $\frac{2}{5}$.

Find:

5. $\frac{1}{2}$ of $\frac{4}{5}$	**7.** $\frac{2}{3}$ of $\frac{3}{7}$	**9.** $\frac{2}{5}$ of $\frac{5}{6}$
6. $\frac{1}{4}$ of $\frac{8}{9}$	**8.** $\frac{2}{3}$ of $\frac{6}{7}$	**10.** $\frac{3}{5}$ of $\frac{5}{8}$

11. What is $\frac{3}{4}$ of $\frac{5}{12}$?

SOLUTION. $\frac{1}{4}$ of $\frac{5}{12} = \frac{5}{48}$; hence $\frac{3}{4}$ of $\frac{5}{12} = 3 \times \frac{5}{48}$, or $\frac{15}{48}$. Observe that $\frac{3}{4}$ of $\frac{5}{12} = \frac{3 \times 5}{4 \times 12} = \frac{15}{48}$, or $\frac{5}{16}$.

Multiply the numerators together and the denominators together, and reduce the result to its lowest terms.

12. Find $\frac{3}{5} \times \frac{4}{7}$. This means the same as $\frac{3}{5}$ of $\frac{4}{7}$; $\frac{3}{5} \times \frac{4}{7} = \frac{12}{35}$.

Find the products:

13. $\frac{5}{8} \times \frac{5}{9}$	**16.** $\frac{3}{8} \times \frac{5}{6}$	**19.** $\frac{8}{9} \times \frac{6}{7}$	**22.** $\frac{3}{11} \times \frac{5}{6}$
14. $\frac{4}{7} \times \frac{8}{9}$	**17.** $\frac{5}{6} \times \frac{8}{11}$	**20.** $\frac{4}{5} \times \frac{8}{9}$	**23.** $\frac{2}{7} \times \frac{6}{7}$
15. $\frac{4}{5} \times \frac{4}{7}$	**18.** $\frac{6}{5} \times \frac{9}{10}$	**21.** $\frac{5}{7} \times \frac{4}{9}$	**24.** $\frac{3}{5} \times \frac{9}{10}$

25. Find $1\frac{1}{2} \times 1\frac{3}{4}$.

Change to improper fractions. Thus, $1\frac{1}{2} \times 1\frac{3}{4} = \frac{3}{2} \times \frac{7}{4} = \frac{21}{8}$, or $2\frac{5}{8}$.

26. $1\frac{2}{3} \times 2\frac{1}{2}$	**29.** $4\frac{1}{3} \times 2\frac{1}{2}$	**32.** $4\frac{3}{5} \times 7\frac{1}{4}$	**35.** $12\frac{1}{2} \times 4\frac{1}{5}$
27. $3\frac{1}{2} \times 2\frac{2}{5}$	**30.** $1\frac{1}{8} \times 2\frac{1}{4}$	**33.** $9\frac{2}{3} \times 12\frac{1}{2}$	**36.** $10\frac{2}{3} \times 3\frac{1}{8}$
28. $3\frac{1}{3} \times 1\frac{1}{3}$	**31.** $3\frac{3}{4} \times 1\frac{1}{2}$	**34.** $6\frac{1}{4} \times 9\frac{3}{4}$	**37.** $12\frac{1}{2} \times 12\frac{1}{2}$

How to use cancellation in multiplication of fractions.

Written Work

1. Find $\frac{2}{3}$ of $\frac{3}{5}$.

(1) $\dfrac{2}{3} \times \dfrac{3}{5} = \dfrac{6}{15}$, or $\dfrac{2}{5}$

(2) $\dfrac{2}{\cancel{3}} \times \dfrac{\cancel{3}}{5} = \dfrac{2}{5}$

In changing $\frac{6}{15}$ to $\frac{2}{5}$, both terms of the frac tion are divided by 3. Hence, in finding the value of $\frac{2}{3} \times \frac{3}{5}$, the work may be shortened by rejecting the factor 3 from both dividend and divisor, as indicated in the second model.

The process of shortening operations by dividing both dividend and divisor by the same number is called **cancellation**.

2. Find the product of $\frac{2}{3} \times 7\frac{1}{2} \times 4$.

$$\dfrac{2}{\cancel{3}} \times \dfrac{\overset{5}{\cancel{15}}}{\cancel{2}} \times \dfrac{4}{1} = \dfrac{20}{1} = 20.$$

Change $7\frac{1}{2}$ to $\frac{15}{2}$. Then you have $\frac{2}{3} \times \frac{15}{2} \times \frac{4}{1}$. Cancel the 2's. Then cancel the factor 3 from the first denominator and the second numerator, leaving the factor 5 in the second numerator. The product of the remaining factors in the numerator is 20; in the denominator **1**. Hence the answer is 20.

3. $\frac{5}{8} \times 2\frac{2}{7} \times 2$

4. $1\frac{3}{7} \times 4\frac{3}{8} \times 1\frac{1}{2}$

5. $4 \times 2\frac{1}{2} \times 1\frac{1}{5}$

6. $\frac{7}{9} \times 3 \times 4\frac{1}{2}$

7. $3 \times \frac{2}{3} \times \frac{3}{4}$

8. $5\frac{1}{2} \times 3\frac{1}{4} \times 4$

9. $6\frac{1}{8} \times 8 \times 2\frac{1}{7}$

10. $5\frac{1}{4} \times 2\frac{1}{3} \times 4$

11. $\frac{2}{3}$ of $\frac{3}{4} \times 6\frac{1}{2}$

12. $\frac{7}{8} \times 8 \times 12\frac{1}{7}$

13. $\frac{9}{10}$ of $3\frac{3}{4} \times 10$

14. $5\frac{1}{2} \times 2\frac{2}{11} \times 3\frac{1}{8}$

15. $5 \times 3\frac{1}{5} \times 3\frac{3}{8}$

16. $16\frac{1}{5} \times 4\frac{1}{9} \times 3$

17. At \$9$\frac{3}{5}$ a pair, find the cost of 15 pairs of lace curtains.

18. Edith knits 1 row of a sock in $\frac{2}{5}$ of a minute. How long does it take her to knit 25 rows?

19. At the rate of $33\frac{1}{4}$ miles an hour, how far will a train travel in $10\frac{2}{3}$ hours?

20. A load of coal weighs $5\frac{3}{8}$ tons. Find the cost at \$8$\frac{2}{5}$ a ton.

1. When the sugar allowance for each person was $2\frac{1}{2}$ tablespoonfuls a day, how many tablespoonfuls was it for a week?

2. In a certain building, during January, $181\frac{9}{10}$ tons of soft coal were consumed. If the coal cost $\$6\frac{1}{4}$ a ton, what was the total expense for coal?

3. If a soldier is allowed $\frac{3}{4}$ of a pound of meat a day, how much meat will supply 280 men for $6\frac{1}{2}$ days?

4. A coal dealer sold 1850 tons of coal. $\frac{3}{5}$ of his sales were of anthracite coal; the rest, of bituminous. The former he sold for $\$9\frac{1}{4}$ a ton; the latter, for $\$6\frac{1}{4}$ a ton. How much were his total sales worth?

5. A school was open $5\frac{3}{4}$ hours each day. How many hours was it open in a month of 20 school days? in a term of $4\frac{1}{2}$ months?

6. A boy lived $1\frac{2}{3}$ miles from his school and attended 150 days in the term. How many miles did he walk in a term both to and from school?

7. A department store employed 120 clerks at $\$12\frac{3}{4}$ a week and 20 wrappers at $\$7\frac{3}{4}$ a week. Find the amount paid to all.

8. Find the cost of sewing buttons on 32 suits at $3\frac{7}{8}$¢ a suit.

9. When a pound sterling of English money is worth $\$4.17\frac{1}{2}$, find the value in United States money of 20 pounds.

10. A rural mail carrier traveled $23\frac{7}{8}$ miles for each delivery. Find the number of miles he traveled in making 310 deliveries.

11. An ocean steamer burned on an average $201\frac{5}{16}$ tons of coal in a day. How much coal did it consume in a voyage of 7 days?

DIVISION OF FRACTIONS

How to divide a whole number by a fraction.
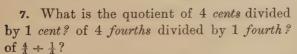
Oral Work

1. How many halves are there in this square?

2. How many times is $\frac{1}{2}$ contained in 1?

3. How many railroad tickets at $\$\frac{1}{2}$ each can be bought for $\$1$? for $\$2$? for $\$4$?

4. What is the quotient of 2 *balls* divided by 1 *ball*? of 2 *cents* divided by 1 *cent*? of 2 *halves* divided by 1 *half*? of $\frac{2}{2} \div \frac{1}{2}$? What is the quotient of 4 *cents* divided by 2 *cents*? of 4 *halves* divided by 2 *halves*? of $\frac{4}{2} \div \frac{2}{2}$? of $\frac{8}{2} \div \frac{2}{2}$?

5. How many *fourths* are there in this square? What, then, is the quotient of 1 divided by $\frac{1}{4}$? of 2 divided by $\frac{1}{4}$?

6. At $\$\frac{1}{4}$ each how many thrift stamps can be purchased for $\$1$? for $\$2$? for $\$3$?

7. What is the quotient of 4 *cents* divided by 1 *cent*? of 4 *fourths* divided by 1 *fourth*? of $\frac{4}{4} \div \frac{1}{4}$?

8. Since $1 = \frac{4}{4}$, is there any difference between the quotients of $1 \div \frac{1}{4}$ and $\frac{4}{4} \div \frac{1}{4}$? Since $2 = \frac{8}{4}$, is there any difference between the quotients of $2 \div \frac{1}{4}$ and $\frac{8}{4} \div \frac{1}{4}$? Since $3 = 1\frac{2}{4}$, is there any difference between the quotients of $3 \div \frac{1}{4}$ and $1\frac{2}{4} \div \frac{1}{4}$?

9. Explain why $2 \div \frac{1}{2} = \frac{4}{2} \div \frac{1}{2}$; $\frac{2}{3} \div \frac{1}{4} = \frac{8}{12} \div \frac{3}{12}$; $\frac{5}{6} \div \frac{1}{5} = \frac{25}{30} \div \frac{6}{30}$.

$1 \div \frac{1}{2} = 2.$

$1 \div \frac{1}{4} = 4.$

Give the quotients:

10. $2 \div \frac{1}{2}$	**14.** $5 \div \frac{1}{3}$	**18.** $12 \div \frac{1}{2}$	**22.** $15 \div \frac{1}{2}$
11. $4 \div \frac{1}{2}$	**15.** $6 \div \frac{1}{4}$	**19.** $10 \div \frac{1}{2}$	**23.** $2 \div \frac{1}{8}$
12. $5 \div \frac{1}{2}$	**16.** $6 \div \frac{1}{3}$	**20.** $9 \div \frac{1}{2}$	**24.** $4 \div \frac{1}{8}$
13. $3 \div \frac{1}{3}$	**17.** $4 \div \frac{1}{5}$	**21.** $4 \div \frac{1}{8}$	**25.** $10 \div \frac{1}{4}$

How to divide a fraction by a whole number or by a fraction by inverting the terms of the divisor.

Oral Work

Just as 2 *inches* are contained in 3 *inches*, $1\frac{1}{2}$ times, or $\frac{3}{2}$ times, so 2 *thirds* are contained in 3 *thirds*, or one, $1\frac{1}{2}$ times, or $\frac{3}{2}$ times. $1 \div \frac{2}{3} = \frac{3}{2}$.

1. How many times are 3 *inches* contained in 5 *inches*? 3 *fifths* in 5 *fifths*, or one? $1 \div \frac{3}{5} = ?$

Since $3 \div 1 = 3$, 3 may be written $\frac{3}{1}$; also, 4 may be written $\frac{4}{1}$, etc. When $\frac{1}{3}$ is changed to $\frac{3}{1}$, 3 or $\frac{3}{1}$ to $\frac{1}{3}$, $\frac{2}{3}$ to $\frac{3}{2}$, or $\frac{3}{5}$ to $\frac{5}{3}$, the fraction is said to be **inverted**. It then shows how many times the fraction is contained in 1.

The quotient of 1 divided by any fraction equals the fraction inverted.

2. Invert the fractions $\frac{1}{2}$, $\frac{3}{10}$, $\frac{5}{8}$, $\frac{3}{8}$, $\frac{7}{1}$, $\frac{9}{8}$, $\frac{5}{1}$, $\frac{8}{1}$.

3. $1 \div \frac{1}{3} = ?$ $1 \div \frac{2}{5} = ?$ $1 \div \frac{3}{4} = ?$ $1 \div \frac{7}{8} = ?$

4. How many times is $\frac{3}{4}$ in. contained in 3 in.? 3 in. $\div \frac{3}{4}$ in. $= ?$ How many times is $\frac{3}{4}$ contained in 3? $3 \div \frac{3}{4} = ?$

Since $1 \div \frac{3}{4} = \frac{4}{3}$, therefore $3 \div \frac{3}{4} = 3 \times \frac{4}{3} = \frac{12}{3}$, or 4.

5. How many times is $\frac{3}{8}$ contained in $\frac{3}{4}$? $\frac{3}{4} \div \frac{3}{8} = ?$

Since $1 \div \frac{3}{8} = \frac{8}{3}$, therefore $\frac{3}{4} \div \frac{3}{8} = \frac{\overset{}{3}}{\underset{1}{4}} \times \frac{\overset{2}{8}}{3} = 2$.

Notice that in each case you invert the terms of the divisor and then multiply.

Find the quotients by inverting the divisor and multiplying:

6. $1 \div \frac{1}{9}$ **9.** $2 \div \frac{2}{3}$ **12.** $\frac{7}{8} \div 7$ **15.** $15 \div \frac{3}{4}$

7. $1 \div \frac{2}{9}$ **10.** $6 \div \frac{3}{4}$ **13.** $\frac{3}{4} \div 12$ **16.** $16 \div \frac{2}{3}$

8. $1 \div \frac{5}{8}$ **11.** $5 \div \frac{5}{6}$ **14.** $\frac{4}{5} \div 16$ **17.** $8 \div \frac{7}{12}$

Written Work

1. Divide $\frac{3}{5}$ by $\frac{3}{10}$.

$$\frac{3}{5} \div \frac{3}{10} = \frac{\cancel{3}}{\cancel{5}} \times \frac{\overset{2}{\cancel{10}}}{\cancel{3}} = 2.$$

Invert the divisor and multiply, using cancellation.

2. Divide $4\frac{1}{2}$ by $\frac{3}{4}$.

$$4\frac{1}{2} = \frac{9}{2}.$$

$$\frac{9}{2} \div \frac{3}{4} = \frac{\overset{3}{\cancel{9}}}{\cancel{2}} \times \frac{\overset{2}{\cancel{4}}}{\cancel{3}} = 6.$$

Change $4\frac{1}{2}$ to the improper fraction $\frac{9}{2}$. Invert the divisor and multiply, using cancellation. The result is 6.

In division of fractions invert the divisor and multiply.

Find the quotients:

3. $26 \div \frac{1}{3}$ **10.** $48 \div \frac{2}{3}$ **17.** $5\frac{3}{8} \div \frac{3}{4}$ **24.** $84 \div \frac{21}{25}$

4. $\frac{7}{8} \div 4$ **11.** $12 \div \frac{3}{5}$ **18.** $18 \div \frac{2}{3}$ **25.** $108 \div \frac{12}{13}$

5. $25 \div \frac{1}{2}$ **12.** $16 \div \frac{4}{5}$ **19.** $25 \div \frac{5}{8}$ **26.** $280 \div \frac{14}{15}$

6. $6\frac{2}{3} \div 2$ **13.** $1\frac{7}{8} \div \frac{3}{4}$ **20.** $\frac{3}{8} \div 15$ **27.** $360 \div \frac{9}{16}$

7. $2\frac{1}{8} \div \frac{1}{2}$ **14.** $2\frac{1}{5} \div \frac{3}{4}$ **21.** $36 \div \frac{9}{10}$ **28.** $285 \div \frac{15}{16}$

8. $1\frac{4}{5} \div \frac{9}{10}$ **15.** $16 \div \frac{2}{3}$ **22.** $63 \div \frac{7}{8}$ **29.** $440 \div \frac{11}{20}$

9. $18 \div \frac{1}{4}$ **16.** $3\frac{1}{2} \div \frac{7}{8}$ **23.** $72 \div \frac{8}{9}$ **30.** $36 \div 3\frac{3}{5}$

SUGGESTION. In Ex. 30, change the divisor to an improper fraction.

Divide:

31. 27 by $2\frac{1}{4}$ **36.** 84 by $4\frac{1}{5}$ **41.** 780 by $7\frac{4}{5}$

32. 33 by $3\frac{2}{3}$ **37.** 75 by $2\frac{7}{9}$ **42.** 355 by $8\frac{7}{8}$

33. 44 by $4\frac{2}{5}$ **38.** 90 by $3\frac{3}{4}$ **43.** 295 by $6\frac{5}{9}$

34. 60 by $3\frac{3}{4}$ **39.** 92 by $2\frac{3}{10}$ **44.** 748 by $3\frac{2}{3}$

35. 76 by $4\frac{3}{4}$ **40.** 85 by $1\frac{8}{9}$ **45.** 549 by $8\frac{5}{7}$

Find the quotients:

46. $7\frac{1}{2} \div 1\frac{1}{2}$ **51.** $12\frac{1}{2} \div 6\frac{1}{4}$ **56.** $3\frac{1}{6} \div 9\frac{1}{2}$

47. $6\frac{2}{3} \div 1\frac{2}{3}$ **52.** $14\frac{2}{7} \div 2\frac{6}{7}$ **57.** $3\frac{2}{7} \div 3\frac{1}{7}$

48. $5\frac{1}{4} \div 1\frac{3}{4}$ **53.** $3\frac{1}{4} \div 2\frac{1}{2}$ **58.** $8\frac{2}{5} \div 6\frac{1}{7}$

49. $8\frac{2}{3} \div 2\frac{1}{6}$ **54.** $5\frac{2}{3} \div 4\frac{1}{5}$ **59.** $9\frac{1}{6} \div 3\frac{1}{2}$

50. $7\frac{1}{3} \div 1\frac{1}{6}$ **55.** $6\frac{1}{8} \div 7\frac{1}{4}$ **60.** $3\frac{9}{10} \div 2\frac{2}{5}$

Divide:

61. $11\frac{2}{5}$ by $3\frac{2}{9}$ **64.** $4\frac{8}{15}$ by $1\frac{5}{12}$ **67.** $10\frac{1}{5}$ by $2\frac{4}{7}$

62. $6\frac{2}{8}$ by $1\frac{8}{9}$ **65.** $7\frac{7}{12}$ by $1\frac{3}{4}$ **68.** $15\frac{5}{8}$ by $2\frac{7}{9}$

63. $10\frac{2}{3}$ by $2\frac{2}{11}$ **66.** $7\frac{3}{5}$ by $2\frac{3}{8}$ **69.** $12\frac{2}{3}$ by $5\frac{2}{8}$

70. How much are buttons per dozen when 72 cents are paid for $2\frac{1}{4}$ dozen?

71. How many dolls' dresses can be cut from $8\frac{3}{4}$ yards of silk, if each dress requires $\frac{7}{8}$ yard?

72. A piece of ribbon containing 10 yards is cut into badges each $\frac{1}{3}$ of a yard in length. How many badges can be cut from the piece?

73. A clerk sells $6\frac{3}{4}$ yards of ribbon for 81 cents. What is the price per yard?

74. At $\$1\frac{1}{5}$ each, how many hats can be bought for $\$14\frac{2}{5}$?

75. A man earns $\$16\frac{1}{2}$ in $5\frac{1}{2}$ days. How much is this a day?

76. The cost of $3\frac{1}{2}$ pounds of sugar is 35 cents. What is the price per pound?

EVERYDAY USE OF NUMBERS

Boy Scouts

1. A boy scout found that he took 40 steps to 100 ft. What was the length of his step measured in feet? in inches?

2. A mile is $52\frac{4}{5}$ times 100 ft. How many steps did the boy take to a mile?

3. Find the cost of this outfit for a troop of 32 boy scouts:

Hat,	$1.75	Belt,	$ .50	Knife,	$1.25
Coat,	$2.15	Neckerchief,	$ .35	First-aid kit,	$ .40
Breeches,	$1.85	Blanket,	$1.50	Watch,	$1.50
Shirt,	$1.50	Haversack,	$2.00	Compass,	$ .75
Leggins,	$1.30	Ax and sheath,	$1.25	Two signal flags,	$1.50

4. A boy scout swam 100 yd. in $74\frac{1}{5}$ sec. At this rate, how long would it take him to swim 150 yd.?

5. A boy scout walked on an average of $2\frac{7}{8}$ mi. an hour. How long did it take him to walk 9 mi.?

6. What is the area of a scout tent 6 ft. × $7\frac{1}{2}$ ft.? $7\frac{1}{2}$ ft. × 8 ft.? $6\frac{1}{4}$ ft. square?

7. The following is a ration list of three meals for 6 boys. At this rate, find the cost of three meals for 24 boys.

2 lb. bacon @	$ .52	3 cans salmon @	$ .25
1 lb. butter @	$ .50	1 lb. sugar @	$ .10
1 doz. eggs @	$ .47	24 lb. potatoes for	$ .25
$\frac{1}{2}$ lb. cocoa @	$ .24	2 cans condensed milk @	$ .16
$\frac{1}{4}$ lb. coffee @	$ .30	1 small package self-raising	
$\frac{1}{4}$ lb. chocolate @	$ .40	flour @	$ .12

Girl Scouts

1. These girl scouts cooked a camp breakfast for their troop of 24 girls. They used $\frac{1}{2}$ lb. oatmeal @ $.12, $1\frac{1}{4}$ lb. bacon @ $.52, 2 loaves of bread for toast @ $.10, $1\frac{1}{8}$ lb. butter @ $.56, 1 lb. coffee @ $.30, 8 qt. milk @ $.15, and $1\frac{1}{2}$ lb. sugar @ $.10. Find the total cost of the breakfast and the cost for each girl.

2. A girl scout walked 100 mi. during July. The first week she walked $18\frac{3}{8}$ mi.; the second week, $20\frac{3}{4}$ mi.; the third week, $22\frac{7}{8}$ mi.; and the fourth week, $28\frac{3}{16}$ mi. How far did she walk the last three days?

3. The Ivy Troop consisted of 4 patrols of 8 members each. Find the cost of this outfit for the troop of 32 girls.

Skirt,	$2.35	Haversack,	$1.60
Middy,	$2.75	Belt,	$1.65
Coat,	$3.25	Knife,	$1.50
Bloomers,	$2.00	First-aid kit,	$ .50
Hat,	$1.65	Sewing kit,	$ .25
Neckerchief,	$ .30		

4. Ruth won the service badge by the following tasks:

(*a*) She made surgical dressings for 30 hr. in a Red Cross workroom. She averaged $1\frac{1}{4}$ hr. a day. How many days did she work?

(*b*) She raised vegetables on a plot 15 ft. × $16\frac{2}{3}$ ft. She paid $2.00 for seeds and fertilizer and sold her vegetables for $7.00. What was her profit per square foot of land?

5. Alice won the green cross badge by taking care of her little sister 30 hr. in June. The first 14 days she worked $1\frac{3}{4}$ hr. each day. How much did she average each day for the remaining days?

PROBLEMS WITHOUT NUMBERS

1. How can you test your answer in addition? in subtraction?

2. You have the cost and the selling price. How can you find the profit or the loss?

3. You know the cost and the profit. How do you find the selling price?

4. You know the selling price and the gain or the loss. How do you find the cost?

5. How can you find a product from its two factors?

6. You have the product and the multiplicand. How do you find the multiplier?

7. When the product and the multiplier are given, how do you find the multiplicand?

8. If the divisor, the quotient, and the remainder are given, tell how you find the dividend.

9. How can you change a fraction to one of higher terms? to one of lower terms?

10. How can you change a fraction to its lowest terms?

11. How can you change a whole number to an improper fraction? a mixed number to an improper fraction?

12. How can you change an improper fraction to a whole number or to a mixed number?

13. How can you add two dissimilar fractions?

14. How can you subtract a fraction from another with a different denominator?

15. You multiply (or divide) the numerator of a fraction by a given number. What must you do to the denominator in order to keep the value of the original fraction unchanged?

TESTS FOR ACCURACY AND SPEED

Find how long it takes you to get the *right answers* to each set of five examples.

I

1. $\frac{1}{8} + \frac{3}{4} + \frac{5}{16}$
2. $\frac{4}{5} - \frac{2}{3}$
3. $6 \times \frac{2}{3}$
4. $24 \div \frac{3}{4}$
5. $48 \times \$.12\frac{1}{2}$

II

1. $1\frac{3}{8} + 4\frac{3}{16} + 3\frac{3}{4}$
2. $\frac{7}{8} - \frac{3}{16}$
3. $5 \times \frac{3}{8}$
4. $300 \div \frac{3}{16}$
5. $21 \times \$.33\frac{1}{3}$

III

1. $20\frac{3}{5} + 43\frac{1}{4} + 39\frac{1}{8}$
2. $12\frac{3}{10} - 4\frac{2}{5}$
3. $\frac{5}{8}$ of 50
4. $150 \div 3\frac{3}{4}$
5. $24 \times \$.16\frac{2}{3}$

IV

1. $12\frac{1}{10} + 14\frac{1}{8} + 23\frac{2}{5}$
2. $48\frac{3}{16} - 29\frac{5}{8}$
3. $10\frac{2}{3} \times 36$
4. $12\frac{1}{2} \div \frac{5}{8}$
5. $16 \times \$.06\frac{1}{4}$

V

1. $17\frac{1}{3} + 18\frac{5}{6} + 33\frac{3}{4}$
2. $\frac{3}{4} + \frac{7}{8} - \frac{1}{2}$
3. $\frac{3}{5}$ of $\frac{4}{5}$
4. $5\frac{3}{4} \div 3\frac{2}{7}$
5. $\$1.00 - \$.12\frac{1}{2}$

VI

1. $\frac{1}{2} + \frac{5}{6} + \frac{3}{4} + \frac{5}{12}$
2. $\frac{2}{3} + \frac{7}{12} - \frac{5}{6}$
3. $\frac{9}{10}$ of $\frac{7}{8}$
4. $600 = \frac{5}{6}$ of $?$
5. $\$1.00 \div \$.33\frac{1}{3}$

VII

1. $\frac{2}{3} + \frac{1}{10} + \frac{3}{5} + \frac{1}{12}$
2. $33\frac{1}{3} + 12\frac{1}{2} - 5\frac{5}{6}$
3. $8\frac{1}{2} \times 3\frac{3}{4}$
4. $700 = \frac{7}{8}$ of $?$
5. $\$6.00 \div \$.16\frac{2}{3}$

VIII

1. $\frac{3}{8} + \frac{5}{16} + \frac{5}{32} + \frac{3}{4}$
2. $29\frac{3}{10} + 13\frac{1}{5} - 8\frac{2}{5}$
3. $10\frac{1}{4} \times 10\frac{5}{8}$
4. $\frac{3}{16}$ of $? = 48$
5. $\$3.00 \div \$.33\frac{1}{3}$

CHAPTER II

REVIEW

ADDITION

Oral Work

Add rapidly the following scores in a bean-bag game :

	a	b	c	d	e	f	g	h	i	j	k
1.	5	7	0	6	5	6	5	7	9	0	8
	6	8	5	5	6	5	0	5	0	8	7
	5	5	8	7	0	0	5	7	7	0	8
	8	0	7	7	8	8	6	8	5	6	5
	9	6	8	8	7	9	6	5	6	9	9

Written Work

Add, observing groups that make 5, 10, 15, 20, etc. Test by adding downwards :

1.	2.	3.	4.
14,223	54,724	60,000	70,927
37,245	57,632	59,725	52,051
45,936	18,206	34,761	61,847
50,649	32,391	9,892	42,536
3,261	1,001	47,634	9,910
702	955	1,078	49,068
30,485	1,417	21,046	5,099

Add and test:

5.	33,313	6.	14,542	7.	21,424	8.	90,009
	91,737		43,036		97,835		56,721
	41,952		33,355		42,067		97,856
	10,090		44,492		72,109		23,081
	79,973		40,001		19,055		59,039
	5,681		10,088		64,562		17,840
	22,200		80,063		8,778		60,029
	79,942		56,702		60,021		60,072

Explain what must be observed in setting down these **sums
to be** added. Then add and test :

9.	$ 4.40	10.	$ 5.10	11.	$ 9.10	12.	$ 5.19
	82.02		26.98		15.10		29.10
	43.00		34.25		27.75		88.25
	12.05		76.80		105.05		56.10
	498.04		155.05		73.10		34.50

13.	$ 8.07	14.	$ 3.75	15.	$ 6.50	16.	$ 8.20
	92.09		49.10		35.52		29.25
	21.10		34.50		1.00		.01
	34.02		62.98		23.06		75.50
	82.75		1.65		17.10		63.50
	59.01		25.60		181.19		43.92

17.	$ 4.29	18.	$ 5.60	19.	$804.98	20.	$546.05
	23.72		29.01		714.09		3012.99
	81.70		38.19		326.50		590.68
	36.01		42.05		995.27		69.10
	49.25		74.92		77.76		7276.23
	31.07		81.74		558.50		19.08
	64.01		25.40		23.17		329.00
	52.90		19.10		655.55		4538.50

SUBTRACTION

Oral Work

1. Explain the terms used in subtraction.

2. From 74 take 53. Thus, $74 - 50 = 24$; $24 - 3 = 21$.
Find differences :

	a	b	c	d	e
3.	95 − 39	63 − 47	76 − 54	15 − 5	60 − 45
4.	58 − 29	90 − 64	50 − 25	35 − 16	87 − 42
5.	71 − 48	81 − 47	78 − 39	56 − 42	67 − 45
6.	54 − 25	78 − 48	67 − 48	99 − 68	25 − 15
7.	71 − 69	88 − 29	58 − 39	23 − 15	89 − 52
8.	39 − 26	80 − 65	45 − 28	54 − 37	90 − 54

Written Work

Subtract and test. Time your work. Then work the exercises again and try to beat your record :

	a	b	c	d	e	f
1.	304	740	985	508	703	745
	289	387	507	390	598	690
2.	9708	4503	5207	3052	4163	8157
	3201	4292	1908	2954	2491	3299
3.	4140	4159	1908	4507	4562	3875
	2977	2786	1454	2972	3989	2651
4.	4062	5098	6703	5192	5099	3029
	3903	3673	4487	4066	4897	2544

Subtract and test :

	a	b	c	d
	a	*b*	*c*	*d*
5.	40,092	70,900	60,251	70,098
	29,819	54,892	39,807	58,919
6.	503,459	623,559	560,734	600,127
	423,602	454,683	384,842	576,774
7.	$ 250.10	$ 892.15	$ 3.726	$ 22.60
	7.42	64.01	.993	1.60
8.	$ 328.67	$ 801.98	$ 27.021	$ 5241.09
	115.01	572.89	19.011	3174.77
9.	$ 3245.90	$ 9108.60	$ 285.99	$ 314.291
	2921.01	7299.01	192.10	189.189
10.	$ 2965.10	$ 1985.20	$ 7818.05	$ 421.987
	1824.01	465.99	659.16	128.243
11.	$ 2009.70	$ 600.90	$ 709.05	$ 700.00
	389.99	398.98	29.87	334.09
12.	$ 4008.60	$ 2690.00	$ 7785.00	$ 6100.01
	487.98	348.98	649.65	78.49
13.	$ 9398.01	$ 8500.00	$ 2008.40	$ 2670.00
	7246.99	6356.29	1268.98	1598.54
14.	$ 1400.00	$ 8780.20	$ 1980.00	$ 4467.01
	1250.75	2563.52	845.24	2247.87
15.	$ 1240.11	$ 6475.14	$ 9550.01	$ 4498.11
	1150.00	4243.87	2480.19	1177.98

MULTIPLICATION

Oral Work

1   Repeat the multiplication tables to 12 × 12.

2   Multiply first by 10, then by 100; then by 1000
4, 8, 12, 15, 18, 25, 30, 35, 40, 50, 75.

Written Work

NOTE.   Wherever possible, use *short methods.*   **Thus, 11 × 1860 = 10
× 1860, + 1 × 1860, or 18,600 + 1860.**

Find the products :

1. 40 × 20	**18.** 68 × 30	**35.** 156 × 3204
2. 20 × 20	**19.** 30 × 70	**36.** 125 × 4009
3. 27 × 35	**20.** 67 × 49	**37.** 609 × 3220
4. 39 × 47	**21.** 53 × 62	**38.** 522 × 3044
5. 84 × 67	**22.** 65 × 98	**39.** 399 × 5673
6. 98 × 42	**23.** 45 × 80	**40.** 968 × 3404
7. 34 × 23	**24.** 99 × 999	**41.** 957 × 1505
8. 56 × 76	**25.** 12 × 1400	**42.** 968 × 9566
9. 30 × 102	**26.** 15 × 2500	**43.** 490 × 5707
10. 45 × 490	**27.** 16 × 1500	**44.** 960 × 7658
11. 68 × 304	**28.** 20 × 1339	**45.** 850 × 4309
12. 50 × 206	**29.** 35 × 3000	**46.** 869 × 2507
13. 54 × 600	**30.** 22 × 25	**47.** 960 × 5003
14. 72 × 503	**31.** 25 × 24	**48.** 101 × 8002
15. 40 × 725	**32.** 32 × 25	**49.** 110 × 4501
16. 68 × 507	**33.** 19 × 45	**50.** 948 × 7620
17. 75 × 462	**34.** 18 × 35	**51.** 859 × 6573

DIVISION

Oral Work

Divide the following numbers first by 6; then by 5; by 4; by 7; 8; 9; 10; 11; 12; 20:

	a	b	c	d	e	f
1.	432	624	709	8140	9102	7000
2.	354	248	900	9210	7054	6033

Written Work

Find the quotients and test :

1. $9500 \div 20$	**19.** $333{,}333 \div 51$	**37.** $77{,}445 \div 860$
2. $5060 \div 45$	**20.** $459{,}875 \div 65$	**38.** $249{,}681 \div 120$
3. $5965 \div 56$	**21.** $648{,}650 \div 76$	**39.** $386{,}406 \div 200$
4. $9543 \div 34$	**22.** $185{,}679 \div 18$	**40.** $10{,}505 \div 500$
5. $4516 \div 87$	**23.** $93{,}567 \div 40$	**41.** $60{,}840 \div 600$
6. $9842 \div 79$	**24.** $50{,}617 \div 10$	**42.** $72{,}400 \div 800$
7. $9819 \div 95$	**25.** $445{,}119 \div 15$	**43.** $97{,}009 \div 694$
8. $444{,}444 \div 19$	**26.** $590{,}170 \div 25$	**44.** $78{,}007 \div 892$
9. $459{,}606 \div 72$	**27.** $7688 \div 31$	**45.** $52{,}475 \div 623$
10. $45{,}675 \div 93$	**28.** $567{,}800 \div 24$	**46.** $70{,}601 \div 961$
11. $486{,}501 \div 41$	**29.** $50{,}875 \div 25$	**47.** $70{,}075 \div 560$
12. $96{,}543 \div 62$	**30.** $65{,}700 \div 40$	**48.** $42{,}882 \div 745$
13. $548{,}672 \div 33$	**31.** $99{,}660 \div 33$	**49.** $48{,}618 \div 125$
14. $56{,}400 \div 54$	**32.** $36{,}550 \div 10$	**50.** $26{,}099 \div 900$
15. $10{,}456 \div 30$	**33.** $15{,}789 \div 15$	**51.** $14{,}014 \div 145$
16. $\dfrac{46802}{20}$	**34.** $484{,}800 \div 48$	**52.** $300{,}909 \div 308$
17. $\dfrac{59185}{7}$	**35.** $25{,}560 \div 18$	**53.** $56{,}630 \div 706$
18. $\dfrac{104658}{55}$	**36.** $4488 \div 22$	**54.** $367{,}047 \div 734$

EVERYDAY USE OF NUMBERS

Oral Work

What is the cost of :

1. 10 lb. of cherries at 25 ¢ a pound ?

2. 9 pt. of milk at 7 ¢ a pint ?

3. 8 bu. of apples at $2 a bushel ?

4. A 12-pound cheese at 20 ¢ a pound ?

5. 3 pk. of apples at 25 ¢ a peck ?

6. ½ pk. beans at 80 ¢ a peck ?

7. 7 baskets peaches at $1.25 a basket ?

8. 10 tons coal at $8.50 a ton ?

9. A boy rides his wheel 6 mi. in one hour   How far does he ride in 7¾ hr. ?

10. A man leaves home at 6.30 A.M. and returns at 5.45 P.M. How long is he away from home ?

11. A train leaves the station at 11.10 A.M. It requires 25 min. to reach the station. At what time must I leave home in order to catch this train ?

12. Harry leaves home at 8.30 A.M., and reaches school at 3 minutes before 9 o'clock. How long is he on the way ?

13. The morning session of school begins at 9 A.M. and closes at 11.30 A.M. The afternoon session begins at 1 P.M. and closes at 3.45 P.M. How long in hours and minutes are both sessions ?

14. A dealer buys 150 bales of hay, averaging 90 lb. to the bale. How many tons and pounds over does he buy ?

15. At 3 ¢ an ounce, how much will 1 lb. of mustard cost ?

16. Find the cost of 100 lb. of nails at 8½ ¢ a pound.

Written Work

1. 2 tons of rolled oats are packed in pound packages. How many packages are there?

2. How many ounces are there in a ton?

3. A load of hay weighs 3000 lb. How many tons does it weigh? What is its value at $14 a ton?

4. Mr. Black feeds his horse 6 qt. of oats 3 times a day. How many bushels of oats does he feed the horse during November, December, and January?

5. How many 8-oz. packages of soda can be put up from 1 ton 300 lb. of soda?

6. A field is 1320 ft. long and 320 ft. wide. How many yards is it around the field?

7. There are 5280 ft. in a mile. How many feet is it from Albany to New York, a distance of 143 mi.?

8. How many feet of picture molding are required for a room 12 ft. wide and 18 ft. long? At 10¢ a foot, how much does it cost?

9. Each of 8 boxes holds 5 lb. 4 oz. of meal. How much do all the boxes hold?

10. What is the cost of 8 barrels of vinegar, averaging 41 gal. 3 qt. a barrel, at 25¢ a gallon?

11. A building is 46 ft. 3 in. wide, and twice as long as wide. Find the distance around the building.

12. Mr. Bell picks 510 pk., 380 pk., and 467 pk. of apples. How many bushels and pecks does he pick?

13. Let each pupil write and solve five *two-step* problems about farms, gardens, purchases in stores, etc.

REDUCTION OF FRACTIONS

1. Change to eighths : $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{4}$.

2. Change to twelfths : $\frac{2}{3}$, $\frac{3}{6}$, $\frac{2}{4}$, $\frac{1}{3}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{5}{6}$.

3. Change to sixteenths : $\frac{2}{8}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{7}{8}$, $\frac{4}{8}$, $\frac{3}{8}$.

4. Change $\frac{8}{12}$ to thirds, $\frac{5}{10}$ to halves, $\frac{8}{16}$ to **fourths**.

Change to lowest terms :

5. $\frac{4}{6}$, $\frac{6}{12}$, $\frac{4}{8}$, $\frac{9}{12}$, $\frac{4}{16}$, $\frac{8}{24}$.

6. $\frac{2}{8}$, $\frac{10}{12}$, $\frac{8}{16}$, $\frac{10}{24}$, $\frac{10}{20}$.

7. $\frac{8}{32}$, $\frac{4}{24}$, $\frac{9}{36}$, $\frac{12}{48}$, $\frac{11}{22}$, $\frac{12}{18}$, $\frac{25}{75}$.

8. $\frac{4}{12}$, $\frac{3}{12}$, $\frac{10}{50}$, $\frac{8}{12}$, $\frac{16}{48}$, $\frac{24}{48}$, $\frac{15}{45}$, $\frac{15}{20}$.

9. $\frac{15}{24}$, $\frac{16}{32}$, $\frac{20}{30}$, $\frac{14}{28}$, $\frac{40}{60}$, $\frac{18}{27}$, $\frac{6}{8}$.

10. $\frac{18}{36}$, $\frac{13}{26}$, $\frac{14}{24}$, $\frac{9}{45}$, $\frac{7}{63}$, $\frac{6}{16}$, $\frac{9}{81}$, $\frac{15}{35}$.

Read as improper fractions :

11. $3\frac{3}{4}$, $4\frac{2}{3}$, $5\frac{7}{12}$, $5\frac{3}{8}$, $4\frac{5}{6}$, $5\frac{3}{8}$, $9\frac{5}{16}$.

12. $14\frac{5}{12}$, $5\frac{4}{8}$, $6\frac{3}{8}$, $8\frac{3}{4}$, $5\frac{5}{6}$, $4\frac{3}{8}$, $5\frac{2}{3}$.

13. $2\frac{1}{4}$, $3\frac{3}{8}$, $6\frac{2}{9}$, $4\frac{3}{4}$, $6\frac{2}{3}$, $5\frac{7}{12}$, $4\frac{11}{12}$.

14. $8\frac{2}{3}$, $3\frac{3}{5}$, $4\frac{3}{10}$, $5\frac{3}{8}$, $4\frac{3}{4}$, $3\frac{7}{12}$.

You have learned that a fraction is a **part of a unit.** Thus, $\frac{1}{2} = \frac{1}{2}$ of 1, $\frac{1}{3} = \frac{1}{3}$ of 1, $\frac{2}{3} = \frac{1}{3}$ of 2 or $\frac{2}{3}$ of 1, $\frac{3}{4} = \frac{1}{4}$ of 3 or $\frac{3}{4}$ of 1.

You have learned also that a fraction may be regarded **as an expression of division** in which the numerator is the dividend and the denominator, the divisor. Thus, $\frac{1}{2} = 1 \div 2$, $\frac{1}{3} = 1 \div 3$, $\frac{2}{3} = 2 \div 3$; $\frac{16}{5} = 16 \div 5 = 3\frac{1}{5}$; $\frac{16}{4} = 16 \div 4 = 4$.

Change to integers or mixed numbers by dividing the **numerator** by the denominator :

15. $\frac{15}{3}$, $\frac{12}{4}$, $\frac{9}{3}$, $\frac{12}{6}$, $\frac{24}{6}$, $\frac{10}{5}$, $\frac{48}{12}$, $\frac{15}{5}$, $\frac{12}{9}$, $\frac{18}{3}$, $\frac{24}{4}$.

16. $\frac{9}{2}$, $\frac{13}{3}$, $\frac{11}{4}$, $\frac{15}{6}$, $\frac{7}{2}$, $\frac{17}{5}$, $\frac{19}{6}$, $\frac{21}{9}$, $\frac{19}{8}$, $\frac{21}{4}$, $\frac{47}{8}$.

Change to integers or mixed numbers:

17. $\frac{32}{8}$, $\frac{31}{6}$, $\frac{42}{7}$, $\frac{48}{16}$, $\frac{16}{8}$, $\frac{56}{7}$, $\frac{28}{7}$, $\frac{14}{6}$, $\frac{27}{8}$.

18. $\frac{64}{8}$, $\frac{25}{2}$, $\frac{21}{7}$, $\frac{45}{9}$, $\frac{72}{9}$, $\frac{14}{7}$, $\frac{34}{8}$, $\frac{13}{2}$, $\frac{15}{4}$.

19. $\frac{56}{8}$, $\frac{36}{9}$, $\frac{81}{9}$, $\frac{43}{4}$, $\frac{17}{3}$, $\frac{18}{8}$, $\frac{52}{8}$, $\frac{19}{12}$, $\frac{24}{12}$.

20. $\frac{54}{12}$, $\frac{37}{12}$, $\frac{14}{8}$, $\frac{43}{10}$, $\frac{50}{10}$, $\frac{68}{8}$, $\frac{29}{7}$, $\frac{43}{9}$, $\frac{50}{16}$.

The **ratio** of two numbers of the same kind is found by dividing the first by the second. Thus, the ratio of 4 to 8 is $4 \div 8$, or $\frac{4}{8}$, or $\frac{1}{2}$. The ratio of 8 to 4 is $8 \div 4$, or 2. The ratio of 3 ft. to 4 ft. is $3 \div 4$, or $\frac{3}{4}$. The ratio of 4 to 3 is $\frac{4}{3}$.

Give the ratio of:

21. 2 to 3	**25.** 10 to 5	**29.** 5 to 10	**33.** 20 to 30
22. 4 to 5	**26.** 3 to 9	**30.** 15 to 20	**34.** 30 to 20
23. 6 to 8	**27.** 7 to 10	**31.** 8 to 12	**35.** 25 to 75
24. 1 to 7	**28.** 9 to 3	**32.** 5 to 15	**36.** 75 to 25

Change to like or similar fractions:

37. $\frac{1}{4}$ and $\frac{1}{6}$	**41.** $\frac{1}{6}$ and $\frac{1}{12}$	**45.** $\frac{1}{4}$ and $\frac{2}{7}$
38. $\frac{2}{3}$ and $\frac{3}{5}$	**42.** $\frac{2}{3}$ and $\frac{1}{4}$	**46.** $\frac{2}{3}$ and $\frac{1}{6}$
39. $\frac{3}{8}$ and $\frac{2}{4}$	**43.** $\frac{3}{4}$ and $\frac{1}{8}$	**47.** $\frac{3}{8}$ and $\frac{1}{4}$
40. $\frac{5}{8}$ and $\frac{3}{4}$	**44.** $\frac{2}{3}$ and $\frac{3}{5}$	**48.** $\frac{3}{4}$ and $\frac{1}{2}$

Change to fractions having their l. c. d.:

49. $\frac{3}{4}$, $\frac{1}{2}$, $\frac{3}{8}$	**51.** $\frac{1}{5}$, $\frac{3}{4}$, $\frac{3}{10}$	**53.** $\frac{3}{4}$, $\frac{5}{8}$, $\frac{3}{16}$	**55.** $\frac{2}{3}$, $\frac{1}{4}$, $\frac{7}{8}$
50. $\frac{3}{4}$, $\frac{1}{2}$, $\frac{2}{5}$	**52.** $\frac{2}{3}$, $\frac{2}{9}$, $\frac{3}{10}$	**54.** $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$	**56.** $\frac{3}{10}$, $\frac{4}{5}$, $\frac{3}{8}$

ADDITION AND SUBTRACTION OF FRACTIONS

Find the sums:

1. $\frac{3}{4}$ and $\frac{3}{16}$	**4.** $\frac{15}{16}$ and $\frac{5}{12}$	**7.** $\frac{7}{20}$ and $\frac{1}{4}$
2. $\frac{3}{8}$ and $\frac{1}{6}$	**5.** $\frac{9}{20}$ and $\frac{1}{4}$	**8.** $\frac{7}{12}$ and $\frac{7}{30}$
3. $\frac{11}{12}$ and $\frac{1}{8}$	**6.** $\frac{5}{8}$ and $\frac{1}{6}$	**9.** $\frac{2}{9}$ and $\frac{1}{6}$

10–18. Find the differences in each example from 1 to 9.

Find the sum or the difference, as indicated in each case:

19. $\frac{3}{4} + \frac{1}{2}$ **23.** $\frac{3}{4} - \frac{5}{8}$ **27.** $\frac{3}{4} - \frac{3}{8}$ **31.** $\frac{3}{4} - \frac{5}{12}$

20. $\frac{2}{5} + \frac{3}{10}$ **24.** $\frac{7}{10} + \frac{1}{2}$ **28.** $\frac{2}{5} + \frac{7}{10}$ **32.** $\frac{5}{8} + \frac{2}{5}$

21. $\frac{1}{4} + \frac{2}{3}$ **25.** $\frac{4}{5} - \frac{1}{2}$ **29.** $\frac{5}{6} + \frac{3}{8}$ **33.** $\frac{5}{6} - \frac{3}{4}$

22. $\frac{3}{4} + \frac{3}{8}$ **26.** $\frac{4}{7} + \frac{4}{5}$ **30.** $\frac{1}{2} - \frac{1}{6}$ **34.** $\frac{1}{8} + \frac{2}{3}$

Add:

35. $18\frac{2}{3}$ **37.** $40\frac{3}{4}$ **39.** $68\frac{2}{8}$ **41.** $75\frac{5}{9}$
　　$21\frac{5}{6}$ 　　　$12\frac{1}{8}$　　　$46\frac{3}{4}$　　　$60\frac{2}{3}$
　　$\underline{14\frac{2}{9}}$ 　　$\underline{10\frac{1}{2}}$　　$\underline{34\frac{5}{8}}$　　$\underline{77\frac{5}{12}}$

36. $45\frac{1}{2}$ **38.** $16\frac{2}{5}$ **40.** $77\frac{3}{10}$ **42.** $89\frac{1}{2}$
　　$48\frac{2}{3}$ 　　　$46\frac{5}{9}$　　　$65\frac{5}{8}$　　　$12\frac{5}{12}$
　　$57\frac{5}{6}$ 　　　$75\frac{5}{6}$　　　$40\frac{3}{4}$　　　$76\frac{3}{4}$
　　$\underline{62\frac{3}{4}}$ 　　$\underline{65\frac{2}{9}}$　　$\underline{97\frac{2}{8}}$　　$\underline{88\frac{5}{6}}$

Subtract:

43. $24\frac{1}{2}$ **47.** $59\frac{5}{6}$ **51.** $25\frac{5}{8}$ **55.** $95\frac{3}{7}$ **59.** $87\frac{2}{3}$
　　$\underline{15\frac{3}{4}}$ 　　$\underline{35\frac{5}{12}}$ 　$\underline{15\frac{1}{6}}$　　$\underline{39\frac{3}{4}}$　　$\underline{45\frac{5}{12}}$

44. $97\frac{1}{6}$ **48.** $25\frac{1}{3}$ **52.** $56\frac{7}{8}$ **56.** $14\frac{1}{4}$ **60.** $78\frac{1}{3}$
　　$\underline{35\frac{1}{2}}$ 　　$\underline{10\frac{3}{4}}$　　$\underline{21\frac{2}{3}}$　　$\underline{9\frac{5}{8}}$　　$\underline{48\frac{1}{2}}$

45. $58\frac{3}{4}$ **49.** $73\frac{1}{4}$ **53.** $61\frac{1}{3}$ **57.** $98\frac{2}{7}$ **61.** $99\frac{7}{10}$
　　$\underline{35\frac{11}{16}}$ 　$\underline{13\frac{5}{6}}$　　$\underline{53\frac{3}{8}}$　　$\underline{87\frac{1}{4}}$　　$\underline{63\frac{5}{12}}$

46. $109\frac{5}{6}$ **50.** $48\frac{2}{3}$ **54.** $68\frac{3}{4}$ **58.** $102\frac{1}{4}$ **62.** $220\frac{7}{20}$
　　$\underline{96\frac{5}{12}}$ 　$\underline{25\frac{3}{4}}$　　$\underline{52\frac{2}{7}}$　　$\underline{87\frac{3}{5}}$　　$\underline{160\frac{5}{12}}$

Give first the sum and then the difference of:

63. $\frac{3}{8}$ and $\frac{3}{10}$ **65.** $1\frac{3}{6}$ and $\frac{7}{12}$ **67.** $2\frac{1}{2}$ and $\frac{5}{12}$

64. $\frac{4}{9}$ and $\frac{3}{10}$ **66.** $\frac{7}{8}$ and $\frac{7}{16}$ **68.** $\frac{7}{8}$ and $\frac{3}{16}$

69. $\frac{3}{4}$ and $\frac{2}{3}$ **71.** $1\frac{5}{6}$ and $\frac{5}{12}$ **73.** $4\frac{1}{3}$ and $5\frac{1}{8}$

70. $\frac{9}{8}$ and $\frac{8}{9}$ **72.** $2\frac{5}{8}$ and $3\frac{1}{4}$ **74.** $\frac{8}{7}$ and $\frac{7}{8}$

Find the answers:

75. $2\frac{1}{2} + 4\frac{7}{8} - 3\frac{2}{3}$

76. $5\frac{2}{3} - 1\frac{5}{9} + 4\frac{7}{12}$

77. $5\frac{5}{6} + 2\frac{1}{2} - 5\frac{5}{16}$

78. $7\frac{3}{4} + 2\frac{5}{16} - 7\frac{7}{8}$

79. $10\frac{1}{10} + 3\frac{3}{4} - 4\frac{7}{12}$

80. $5\frac{5}{8} - 4\frac{3}{4} + 7\frac{5}{9}$

81. $6\frac{1}{6} + 4\frac{2}{3} - 1\frac{3}{16}$

82. $8\frac{5}{6} + 2\frac{5}{16} - 7\frac{1}{8}$

83. $3\frac{1}{3} + 5\frac{7}{8} - 6\frac{7}{10}$

84. $2\frac{7}{12} + \frac{3}{10} - \frac{4}{5}$

85. $\frac{3}{4} + 2\frac{7}{8} - 3\frac{1}{12}$

86. $3\frac{9}{16} - \frac{3}{4} + 5\frac{5}{9}$

87. $3\frac{11}{12} - 2\frac{7}{8} + 3\frac{5}{6}$

88. $1\frac{9}{10} - \frac{3}{16} + \frac{7}{8}$

89. $5\frac{1}{7} + 3\frac{11}{14} - 2\frac{1}{2}$

90. $8\frac{3}{4} - 1\frac{9}{16} + 5\frac{7}{10}$

91. $3\frac{5}{6} - \frac{11}{12} + 7\frac{2}{9}$

92. $3\frac{5}{9} - \frac{7}{10} + 3\frac{3}{4}$

93. $2\frac{1}{5} + 4\frac{7}{15} + 9\frac{7}{12}$

94. $3\frac{9}{10} - \frac{11}{15} + 4\frac{5}{9}$

95. $\frac{11}{12} + 3\frac{9}{10} - 3\frac{5}{8}$

96. $2\frac{5}{6} + \frac{3}{14} + 7\frac{7}{12}$

MULTIPLICATION OF FRACTIONS

Give the products:

1. $8 \times \frac{3}{6}$ **4.** $7 \times \frac{8}{9}$ **7.** $12 \times \frac{5}{16}$

2. $6 \times \frac{5}{7}$ **5.** $8 \times \frac{4}{7}$ **8.** $8 \times \frac{4}{15}$

3. $11 \times \frac{2}{9}$ **6.** $10 \times \frac{5}{11}$ **9.** $9 \times \frac{11}{14}$

Find:

10. $\frac{2}{3}$ of 8   **13.** $\frac{4}{9}$ of 14   **16.** $\frac{2}{7}$ of 18   **19.** $\frac{3}{16}$ of 23

11. $\frac{5}{6}$ of 7   **14.** $\frac{3}{4}$ of 15   **17.** $\frac{3}{11}$ of 12   **20.** $\frac{2}{15}$ of 11

12. $\frac{7}{8}$ of 19   **15.** $\frac{4}{5}$ of 16   **18.** $\frac{5}{12}$ of 11   **21.** $\frac{3}{20}$ of 17

Find:

22. $\frac{2}{3}$ of $\frac{5}{9}$ **25.** $\frac{3}{5}$ of $\frac{7}{8}$ **28.** $\frac{5}{12}$ of $\frac{5}{7}$ **31.** $\frac{3}{7}$ of $\frac{4}{15}$

23. $\frac{3}{4}$ of $\frac{7}{8}$ **26.** $\frac{7}{8}$ of $\frac{3}{4}$ **29.** $\frac{5}{16}$ of $\frac{5}{8}$ **32.** $\frac{7}{20}$ of $\frac{7}{8}$

24. $\frac{5}{6}$ of $\frac{11}{12}$ **27.** $\frac{8}{9}$ of $\frac{10}{11}$ **30.** $\frac{2}{15}$ of $\frac{4}{5}$ **33.** $\frac{3}{16}$ of $\frac{5}{7}$

CANCELLATION

1. Find $\frac{7}{8}$ of $\frac{8}{9}$.

(1) $\dfrac{7}{8}$ of $\dfrac{8}{9} = \dfrac{56}{72} = \dfrac{7}{9}$

(2) $\dfrac{7}{\cancel{8}} \times \dfrac{\cancel{8}}{9} = \dfrac{7}{9}$

In changing $\frac{56}{72}$ to $\frac{7}{9}$, both terms of the fraction are divided by 8. The work may be shortened by canceling the factor 8 from both dividend and divisor, as indicated in the second model. This reduces the answer to lowest terms by taking out common factors before multiplying.

In the following operations, cancel whenever possible.

Multiply:

2. $16 \times \frac{3}{8}$	**7.** $12 \times \frac{11}{3}$	**12.** $\frac{8}{15}$ of 25
3. $24 \times \frac{7}{8}$	**8.** $13 \times \frac{19}{26}$	**13.** $\frac{7}{24}$ of 15
4. $27 \times \frac{2}{3}$	**9.** $14 \times \frac{11}{12}$	**14.** $\frac{12}{25}$ of 10
5. $45 \times \frac{4}{9}$	**10.** $12 \times \frac{16}{5}$	**15.** $\frac{13}{14}$ of 28
6. $18 \times \frac{10}{3}$	**11.** $10 \times \frac{7}{20}$	**16.** $\frac{7}{9}$ of 81

17. $\frac{3}{16}$ of 30
18. $\frac{5}{12}$ of 50
19. $\frac{7}{15}$ of 75
20. $\frac{8}{11}$ of 66
21. $\frac{7}{16}$ of 64

Find:

22. $\frac{2}{8}$ of $\frac{3}{4}$	**27.** $\frac{2}{3}$ of $\frac{5}{6}$	**32.** $\frac{3}{4}$ of $\frac{4}{8}$
23. $\frac{2}{3}$ of $\frac{8}{10}$	**28.** $\frac{2}{7}$ of $\frac{14}{15}$	**33.** $\frac{7}{12}$ of $\frac{12}{13}$
24. $\frac{3}{4}$ of $\frac{6}{7}$	**29.** $\frac{5}{7}$ of $\frac{14}{15}$	**34.** $\frac{9}{10}$ of $\frac{15}{18}$
25. $\frac{2}{5}$ of $\frac{10}{11}$	**30.** $\frac{2}{3}$ of $\frac{3}{16}$	**35.** $\frac{5}{11}$ of $\frac{22}{25}$
26. $\frac{4}{5}$ of $\frac{5}{8}$	**31.** $\frac{5}{6}$ of $\frac{12}{13}$	**36.** $\frac{7}{11}$ of $\frac{22}{25}$

Find:

37. $9 \times 2\frac{1}{4}$	**42.** $8\frac{1}{2} \times 7$	**47.** $27 \times 12\frac{5}{36}$
38. $12 \times 3\frac{2}{3}$	**43.** $2\frac{7}{15} \times 10$	**48.** $19 \times 8\frac{1}{3}$
39. $18 \times 5\frac{3}{8}$	**44.** $9\frac{5}{12} \times 16$	**49.** $26 \times 5\frac{7}{39}$
40. $22 \times 4\frac{3}{10}$	**45.** $8\frac{2}{7} \times 24$	**50.** $36 \times 7\frac{1}{3}$
41. $21 \times 2\frac{5}{14}$	**46.** $7\frac{13}{14} \times 32$	**51.** $42 \times 8\frac{1}{12}$

**—7

52. Find the product of $\frac{2}{3} \times 7\frac{1}{2} \times 3$.

$\frac{2}{3} \times 7\frac{1}{2} \times 3 =$

$\cancel{\frac{2}{3}} \times \frac{15}{\cancel{2}} \times \frac{\cancel{3}}{1} = 15$

Reduce the mixed number to an improper fraction. Cancel first the factor 2 from dividend and divisor; then the factor 3. The product is $\frac{15}{1}$, or 15.

Find the products, canceling when possible :

53. $5\frac{3}{5} \times \frac{5}{6} \times \frac{1}{2}$

54. $3\frac{1}{3} \times \frac{4}{5} \times \frac{3}{4}$

55. $7\frac{1}{5} \times \frac{4}{9} \times \frac{5}{7}$

56. $5 \times \frac{5}{8} \times \frac{1}{5}$

57. $\frac{7}{8} \times 4 \times \frac{3}{7}$

58. $4\frac{1}{4} \times \frac{3}{8} \times \frac{5}{6} \times \frac{1}{4}$

59. $4 \times \frac{3}{4} \times \frac{5}{7} \times \frac{1}{2}$

60. $\frac{5}{12} \times \frac{2}{3} \times 2\frac{1}{4} \times \frac{3}{8}$

61. $4\frac{2}{3} \times \frac{2}{7} \times \frac{3}{8} \times \frac{5}{6}$

62. $\frac{2}{9} \times \frac{3}{11} \times 7\frac{1}{3} \times \frac{1}{2}$

63. $5\frac{1}{4} \times \frac{3}{7} \times \frac{2}{5} \times \frac{5}{8}$

64. $\frac{3}{10} \times \frac{5}{8} \times \frac{3}{4} \times \frac{8}{9}$

65. $\frac{7}{10} \times 5\frac{4}{5} \times \frac{3}{10} \times \frac{1}{2}$

66. $2\frac{7}{10} \times \frac{2}{5} \times \frac{5}{7} \times \frac{1}{2}$

67. $7\frac{1}{2} \times \frac{3}{5} \times \frac{3}{10}$

68. $3\frac{4}{5} \times \frac{3}{10} \times \frac{1}{2} \times 2\frac{2}{3}$

69. $2\frac{5}{16} \times \frac{3}{8} \times \frac{3}{16} \times 1\frac{1}{2}$

70. $2\frac{2}{3} \times 4\frac{3}{4} \times \frac{2}{5} \times 1\frac{1}{4}$

71. $5\frac{1}{8} \times 4\frac{2}{3} \times 8\frac{1}{2} \times \frac{1}{2}$

72. $1\frac{4}{9} \times \frac{3}{4} \times \frac{3}{8} \times 3\frac{3}{10}$

Find the answers in lowest terms :

73. $\frac{1}{4}$ of $\frac{3}{10}$ of $\frac{3}{4}$

74. $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{5}{8}$

75. $\frac{4}{5}$ of $\frac{3}{10}$ of $\frac{2}{3}$

76. $\frac{1}{6}$ of $\frac{3}{8}$ of $\frac{1}{2}$

77. $\frac{3}{4}$ of $3\frac{1}{4}$ of 4

78. $\frac{2}{3}$ of $2\frac{1}{2}$ of 2

79. $\frac{4}{6}$ of $\frac{5}{6}$ of $\frac{2}{3}$

80. $\frac{5}{8}$ of $\frac{3}{10}$ of $\frac{1}{3}$

81. $\frac{2}{3}$ of $\frac{1}{8}$ of $\frac{2}{5}$

82. $\frac{1}{2}$ of $\frac{1}{8}$ of $\frac{1}{10}$

83. $\frac{3}{10}$ of $\frac{3}{8}$ of $\frac{7}{10}$

84. $\frac{3}{8}$ of $\frac{2}{9}$ of $\frac{4}{5}$

85. $\frac{5}{8}$ of $2\frac{1}{3}$ of $\frac{1}{7}$

86. $\frac{4}{5}$ of $\frac{3}{4}$ of $\frac{5}{8}$

87. $\frac{1}{8}$ of $\frac{3}{4}$ of $\frac{2}{3}$

88. $\frac{1}{6}$ of $\frac{3}{8}$ of $\frac{8}{9}$

89. $\frac{1}{2}$ of $\frac{1}{4}$ of $\frac{1}{8}$

90. $\frac{3}{8}$ of $\frac{3}{4}$ of $\frac{1}{4}$

91. $4\frac{1}{2} \times \frac{3}{4} \times 5\frac{1}{2}$

92. $4\frac{2}{3} \times \frac{1}{4} \times \frac{3}{10}$

93. $4\frac{1}{5} \times 6\frac{1}{3} \times 5$

94. $25\frac{1}{2} \times 12\frac{1}{4} \times \frac{1}{3}$

95. $\frac{3}{4}$ of $4\frac{1}{2}$ of $\frac{2}{3}$

96. $\frac{9}{10}$ of $2\frac{1}{2}$ of $\frac{1}{3}$

DIVISION OF FRACTIONS

Written Work

Find the quotients, canceling when possible :

1. $4 \div \frac{1}{3}$
2. $1\frac{1}{5} \div \frac{2}{3}$
3. $5 \div \frac{3}{4}$
4. $\frac{7}{8} \div \frac{2}{3}$
5. $\frac{11}{16} \div \frac{7}{16}$
6. $\frac{5}{6} \div \frac{7}{8}$
7. $\frac{7}{12} \div \frac{5}{12}$
8. $\frac{15}{16} \div 8$
9. $\frac{6}{7} \div 5$
10. $\frac{11}{12} \div 6$
11. $\frac{21}{25} \div 7$
12. $\frac{15}{16} \div 10$
13. $22\frac{3}{4} \div 13$
14. $35\frac{1}{6} \div 16$
15. $17\frac{2}{3} \div 12$
16. $2\frac{1}{2} \div 2\frac{1}{3}$
17. $12\frac{1}{2} \div 16\frac{2}{3}$
18. $8\frac{2}{3} \div 4\frac{3}{4}$
19. $5\frac{1}{5} \div 4\frac{1}{4}$

20. $7\frac{3}{8} \div 6\frac{1}{2}$
21. $8\frac{4}{5} \div 4\frac{1}{4}$
22. $1\frac{1}{6} \div \frac{5}{6}$
23. $8 \div \frac{7}{8}$
24. $7 \div \frac{4}{5}$
25. $\frac{3}{4} \div \frac{7}{8}$
26. $\frac{5}{9} \div \frac{3}{10}$
27. $\frac{3}{7} \div \frac{5}{14}$
28. $\frac{13}{16} \div \frac{3}{4}$
29. $\frac{19}{20} \div 19$
30. $\frac{11}{14} \div 14$
31. $\frac{19}{11} \div 11$
32. $\frac{15}{16} \div 32$
33. $\frac{11}{14} \div 28$
34. $41\frac{7}{8} \div 22$
35. $37\frac{1}{3} \div 10$
36. $18\frac{1}{4} \div 32$
37. $18\frac{2}{7} \div 7\frac{1}{9}$
38. $19\frac{3}{8} \div 1\frac{3}{5}$

39. $160 \div \frac{5}{8}$
40. $16\frac{3}{7} \div 6\frac{9}{11}$
41. $77 \div 2\frac{4}{3}$
42. $103 \div 10\frac{3}{10}$
43. $10 \div \frac{2}{5}$
44. $1\frac{1}{4} \div \frac{1}{4}$
45. $12 \div \frac{3}{7}$
46. $1\frac{2}{3} \div \frac{3}{4}$
47. $5\frac{4}{5} \div 2\frac{5}{6}$
48. $3\frac{3}{4} \div 4$
49. $5\frac{7}{8} \div 10$
50. $3\frac{5}{6} \div 25$
51. $9\frac{1}{3} \div 14$
52. $\frac{3}{10} \div 27$
53. $\frac{12}{25} \div 15$
54. $\frac{19}{25} \div 38$
55. $51\frac{3}{7} \div 20$
56. $29\frac{2}{11} \div 9$
57. $46\frac{2}{5} \div 15$

FRACTIONAL RELATIONS

How to find what part one number is of another.

Oral Work

1. What part of 4 is 2 ?   2 is $\frac{2}{4}$ of 4, or $\frac{1}{2}$ of 4.
2. What part of 4 is 3 ?   3 is $\frac{3}{4}$ of 4.
3. 4 is what part of 6 ?   4 is $\frac{4}{6}$ of 6, or $\frac{2}{3}$ of 6.
4. 8 is what part of 12 ?   8 is $\frac{8}{12}$ of 12, or $\frac{2}{3}$ of 12.

Notice in each case that the number immediately following " what part of " is the denominator and the other number the numerator of the fraction formed.

5. What part of 10 is 5 ?   What part of 9 is 3 ?
6. What part of 16 is 4 ?   What part of 30 is 10 ?
7. What part of a quart is a pint ?
8. What part of a gallon is a quart ?
9. What part of a yard is a foot ?

10. A baseball team played 8 games and won 6.   What part of the games played did they win ?

11. Margaret had 8 problems out of 10 right on an arithmetic test.   What part of all the problems did she have right ?

12. Paul earned $15 a week and Anna earned $10.   What part of Paul's earnings were Anna's ?

13. The price of some buttons rose from 10¢ a dozen in 1900 to 50¢ a dozen in 1920.   What part of the 1920 price was the 1900 price ?

What part of :

14. 8 is 2 ?	18. 15 is 5 ?	22. 18 is 9 ?
15. 14 is 7 ?	19. 12 is 3 ?	23. 18 is 6 ?
16. 16 is 8 ?	20. 16 is 2 ?	24. 28 is 4 ?
17. 25 is 5 ?	21. 10 is 2 ?	25. 27 is 3 ?

Written Work

1. What part of 36 is 12 ?

$\frac{12}{36} = \frac{1}{3}$ Make the number 36, following "what part of", the denominator and the other number 12 the numerator of a fraction and reduce it to its lowest terms.

2. What part of ¢60 is $15 ?

3. What part of $48 is $16 ?

4. 60 is how many times 15 ? 48 is how many times 16 ?

60 = $\frac{60}{15}$, or 4, times 15. 48 = $\frac{48}{16}$, or 3, times 16.

Since $\frac{60}{15}$ and $\frac{48}{16}$ are improper fractions (or parts) we sometimes express the questions like those in Ex. 4 as follows:

5. What part of 15 is 60 ? (*Ans.* $\frac{60}{15}$.) What part of 16 is 48 ? (*Ans.* $\frac{48}{16}$.)

6. When 6 quarts of milk cost 84 ¢, how much do 10 quarts cost ? 15 quarts ? 20 quarts ?

SUGGESTION. $\frac{10}{6}$ of 84 ¢ = ? $\frac{15}{6}$ of 84 ¢ = ? $\frac{20}{6}$ of 84 ¢ = ?

7. Elizabeth buys 3 yards of ribbon for 25 ¢. At the same rate, how much would she pay for 6 yards ?

8. A woodsman cuts 15 cords of wood in 6 days. How many cords, at the same rate, could he cut in 48 days ?

9. In New York $9\frac{1}{4}$ inches of rain fell in 3 months. At that rate, how much would fall in a year ?

10. A man pays $3675 for 60 acres of land. At the same rate, how much should he pay for 120 acres ?

11. When 5 tons of coal cost $47.50, how much do 30 tons cost ?

12. If 30 bushels of oats cost $25.50, how much do 60 bushels cost ?

13. A man receives 7\frac{1}{2}$ for 2 days' work. At the same rate, how much should he receive for 12 days' work ?

14. A clerk earns $180 in 2 months. At the same rate, how much does he earn in a year ?

How to find a number when a fractional part of it is given.

Oral Work

1. A school team won 12 games of baseball, or $\frac{2}{3}$ of the games they played. How many games did they play?

SOLUTION. $\frac{2}{3}$ × the games played = 12 games. Hence 12 is the product of the factor $\frac{2}{3}$ by another factor, which is the required number. Therefore the required number = $12 \div \frac{2}{3}$, or 18. (See definition of *division,* second paragraph, p. 22.)

Find the number when:

2. $\frac{2}{3}$ of the number = 16	**7.** $\frac{6}{7}$ of the number = 12
3. $\frac{3}{4}$ of the number = 9	**8.** $\frac{9}{11}$ of the number = 36
4. $\frac{5}{9}$ of the number = 15	**9.** $\frac{5}{16}$ of the number = 60
5. $\frac{7}{8}$ of the number = 21	**10.** $\frac{5}{8}$ of the number = 45
6. $\frac{3}{7}$ of the number = 18	**11.** $\frac{7}{8}$ of the number = 28

12. There were 18 girls present. This number was $\frac{2}{3}$ of all the pupils in the class. How many pupils were there in the class?

13. James deposited $18 in the school savings bank, which was $\frac{3}{4}$ of what he earned during the month. How much did he earn in the month?

14. Mary spelled correctly 27 words, which were $\frac{9}{10}$ of all the words given. How many words were given?

15. A farmer sold 42 lambs, which were $\frac{6}{7}$ of his flock. How many lambs had he at first?

16. John attended school 40 days, or $\frac{2}{9}$ of the number of days in the term. Find the number of days in the term.

17. Mr. Tanner paid $12 each quarter for his telephone. At the same rate, how much did he pay in a year?

18. Mr. Haig spent $1200 a year for food. This was $\frac{2}{5}$ of his salary. What was his salary?

Written Work

1. Mr. Clark pays $600 for rent, which is $\frac{3}{10}$ of his salary. What is his salary?

$$\$600 \div \frac{3}{10} = \$\overset{200}{\cancel{600}} \times \frac{10}{\cancel{3}} = \$2000$$

$600 = $\frac{3}{10}$ × the salary. Hence $600 is the product of $\frac{3}{10}$ by another factor, which is the number of dollars of salary. Hence the salary = $600 ÷ $\frac{3}{10}$, or $2000.

Divide the number by the fraction.
Find the number when:

2. $\frac{8}{15}$ of the number = 56 **5.** $\frac{8}{9}$ of the number = 240 ft.

3. $\frac{12}{25}$ of the number = 108 **6.** $\frac{9}{20}$ of the number = 378 bu.

4. $\frac{5}{16}$ of the number = 275 **7.** $\frac{11}{12}$ of the number = 550 lb.

8. At a sale a sideboard was sold for $80 or $\frac{4}{5}$ of the regular price. What was the regular price?

9. The price of butter in 1918 was 60 ¢ a pound. This was $\frac{10}{3}$ of the price in 1898. What was the price in 1898?

10. Mr. Adams sold his farm for $13,608, which was $\frac{6}{5}$ of the cost. What was the cost of the farm?

11. A boy bought a sled at a sale for $1.50. This was $\frac{5}{8}$ of the original cost. What was the original cost?

The following sale prices were $\frac{2}{3}$ of the original prices of the articles. Find the original prices.

12. Gloves $1.50 **15.** Suits $50.00 **18.** Rugs $48.00

13. Shoes $4.00 **16.** Waists $2.50 **19.** Lamps $8.50

14. Hats $5.00 **17.** Skirts $4.50 **20.** Chairs $6.48

The following wholesale prices were $\frac{3}{4}$ of the retail prices. Find the retail prices.

21. Bags $3.15 **24.** Belts $1.47 **27.** Tables $12.45

22. Shirts $1.50 **25.** Coats $15.27 **28.** Books $1.95

23. Caps $1.20 **26.** Skirts $6.60 **29.** Clocks $2.52

PARTS OF ONE DOLLAR AND OF ONE HUNDRED

1. How many times is $5 \not\subset$ contained in $1? in $10 \not\subset$? in $20 \not\subset$? in $25 \not\subset$? in $50 \not\subset$?

2. Multiply $12\frac{1}{2} \not\subset$ by 8. How many times is $12\frac{1}{2} \not\subset$ contained in $1?

3. How many times is $8\frac{1}{3} \not\subset$ contained in $1?

SOLUTION. $8\frac{1}{3} \not\subset = \frac{25}{3} \not\subset$. $100 \not\subset \div \frac{25}{3} \not\subset = 12$. Therefore $8\frac{1}{3} \not\subset$ is contained 12 times in $1.

4. Show, as in Ex. 3, how many times $33\frac{1}{3} \not\subset$ is contained in $1.

5. Tell how many times 5 is contained in 100; in 10; in 20; in 25; in 50; in $6\frac{1}{4}$; in $16\frac{2}{3}$; in $12\frac{1}{2}$; in $8\frac{1}{3}$; in $33\frac{1}{3}$.

6. Learn the following table:

FRACTIONAL PARTS OF $1:		FRACTIONAL PARTS OF 100:	
$50 \not\subset = \$\frac{1}{2}$	$12\frac{1}{2}\not\subset = \$\frac{1}{8}$	$50 = \frac{1}{2}$ of 100	$12\frac{1}{2} = \frac{1}{8}$ of 100
$33\frac{1}{3}\not\subset = \$\frac{1}{3}$	$10 \not\subset = \$\frac{1}{10}$	$33\frac{1}{3} = \frac{1}{3}$ of 100	$10 = \frac{1}{10}$ of 100
$25 \not\subset = \$\frac{1}{4}$	$8\frac{1}{3}\not\subset = \$\frac{1}{12}$	$25 = \frac{1}{4}$ of 100	$8\frac{1}{3} = \frac{1}{12}$ of 100
$20 \not\subset = \$\frac{1}{5}$	$6\frac{1}{4}\not\subset = \$\frac{1}{16}$	$20 = \frac{1}{5}$ of 100	$6\frac{1}{4} = \frac{1}{16}$ of 100
$16\frac{2}{3}\not\subset = \$\frac{1}{6}$	$5 \not\subset = \$\frac{1}{20}$	$16\frac{2}{3} = \frac{1}{6}$ of 100	$5 = \frac{1}{20}$ of 100

Tell at sight what fractional part of a dollar each of the following is:

7. $6\frac{1}{4}\not\subset$ **9.** $8\frac{1}{3}\not\subset$ **11.** $12\frac{1}{2}\not\subset$ **13.** $20\not\subset$ **15.** $50\not\subset$

8. $25\not\subset$ **10.** $33\frac{1}{3}\not\subset$ **12.** $16\frac{2}{3}\not\subset$ **14.** $10\not\subset$ **16.** $5\not\subset$

What part of 100 is:

17. 50 **19.** $6\frac{1}{4}$ **21.** 20 **23.** $16\frac{2}{3}$ **25.** 5

18. 25 **20.** $8\frac{1}{3}$ **22.** $12\frac{1}{2}$ **24.** $33\frac{1}{3}$ **26.** $12\frac{1}{2}$

27. When gingham costs $12\frac{1}{2}$ ¢ a yard, what is the cost of 48 yards?

SOLUTION. $12\frac{1}{2}$¢ $= \$\frac{1}{8}$, cost of 1 yd.; $48 \times \$\frac{1}{8} = \$\frac{48}{8}$, or $6, cost of 48 yd.

	NUMBER OF YARDS, POUNDS, ETC. PURCHASED	PRICE PER YARD, POUND, ETC.	TOTAL COST
28.	42 lb. coffee	$33\frac{1}{3}$¢	$14
29.	32 lb. prunes	$12\frac{1}{2}$¢	?
30.	18 lb. raisins	$16\frac{2}{3}$¢	?
31.	48 boxes berries . . .	$8\frac{1}{3}$¢	?
32.	80 qt. cranberries . . .	$6\frac{1}{4}$¢	?
33.	160 doz. lemons	20¢	?
34.	40 ball bats	25¢	?
35.	50 writing tablets . . .	2 for 25¢	?
36.	30 lb. nuts	50¢	?

37. Find the cost of 40 neckties at 25¢ each.

SOLUTION.   40 neckties at 25¢ ($\$\frac{1}{4}$) each cost $\$\frac{40}{4}$, or $10.

Find the cost of :

38. 35 caps @ 50¢.

39. 48 toys @ $6\frac{1}{4}$¢.

40. 50 collars @ 25¢.

41. 72 yd. gingham @ $12\frac{1}{2}$¢.

42. 60 boxes berries @ $8\frac{1}{3}$¢.

43. 8 yd. ribbon @ $12\frac{1}{2}$¢.

44. 80 boys' shirts @ 50¢.

45. 21 yd. lawn @ $33\frac{1}{3}$¢.

46. 42 yd. lace @ $16\frac{2}{3}$¢.

47. 64 balls @ $6\frac{1}{4}$¢.

48. 40 oranges @ 5¢.

49. 32 melons @ $6\frac{1}{4}$¢.

50. 20 stamps @ 5¢.

51. 72 gas mantles @ $8\frac{1}{3}$¢.

52. 24 pads @ $12\frac{1}{2}$¢.

53. 40 collars @ $12\frac{1}{2}$¢.

54. Make problems asking for the cost of a given number of articles @ 20¢; @ 10¢; @ 25¢; @ 5¢; @ $33\frac{1}{3}$¢; @ 50¢; @ $12\frac{1}{2}$¢; @ $8\frac{1}{3}$¢: @ $6\frac{1}{4}$¢; @ $16\frac{2}{3}$¢.

55. Find by a short method the number of boxes of berries, at $8\frac{1}{3}$ ¢ each, that can be bought for $2.

SOLUTION. As $8\frac{1}{3}$ ¢ is $\frac{1}{12}$, at $8\frac{1}{3}$ ¢ each you can buy 12 boxes for $1.00. For $2 you can buy 2×12 boxes, or 24 boxes.

Make and solve problems with the following conditions:

COST PRICE	AMOUNT OF PURCHASE	NUMBER PURCHASED
56. 10 ¢ each	$ 3.00	?
57. $6\frac{1}{4}$ ¢ each	4.00	?
58. $12\frac{1}{2}$ ¢ each	5.00	?
59. $8\frac{1}{3}$ ¢ each	6.00	?
60. 20 ¢ each	7.00	?
61. 25 ¢ each	8.00	?
62. 50 ¢ each	20.00	?
63. $16\frac{2}{3}$ ¢ each	25.00	?
64. $6\frac{1}{4}$ ¢ each	10.00	?

Divide by the short method :

65. $2 by 10 ¢
66. $8 by 25 ¢
67. $5 by $6\frac{1}{4}$ ¢
68. $3 by $8\frac{1}{3}$ ¢
69. $4 by $12\frac{1}{2}$ ¢
70. $8 by $33\frac{1}{3}$ ¢
71. $9 by $16\frac{2}{3}$ ¢

72. $8 by 5 ¢
73. $12 by 10 ¢
74. $10 by $33\frac{1}{3}$ ¢
75. $12 by 50 ¢
76. $25 by $33\frac{1}{3}$ ¢
77. $70 by $6\frac{1}{4}$ ¢
78. $40 by $12\frac{1}{2}$ ¢

79. $12 by $12\frac{1}{2}$ ¢
80. $20 by $16\frac{2}{3}$ ¢
81. $40 by 20 ¢
82. $50 by $6\frac{1}{4}$ ¢
83. $16 by $12\frac{1}{2}$ ¢
84. $30 by $16\frac{2}{3}$ ¢
85. $20 by $33\frac{1}{3}$ ¢

86. Make problems asking for the number of articles @ $6\frac{1}{4}$ ¢, $16\frac{2}{3}$ ¢, 20 ¢, 25 ¢, 50 ¢, $8\frac{1}{3}$ ¢, $33\frac{1}{3}$ ¢, and $12\frac{1}{2}$ ¢, that can be purchased for a given amount of money.

EVERYDAY MEASUREMENTS

Oral Work

A concrete number whose unit is a measure established by custom or by law is called a **denominate number**; as, 5 yards, in which 1 yard is the unit of measure, or 8 bushels, in which 1 bushel is the unit.

1. Give orally the table for measuring *liquids;* then write this table with proper abbreviations.

2. Write the names of some articles sold by *liquid* measure in a grocery store.

3. Give orally the table used for measuring *dry and bulky articles;* then write this table with proper abbreviations.

4. Write the names of some articles sold by *dry* measure in a grocery store.

5. Give orally the table used for measuring *coal, hay*, etc.; then write the table with proper abbreviations.

6. Give the names and the prices of different articles sold by the *hundredweight* or by the *ton.*

7. Give orally the table for measuring *time;* then write it with proper abbreviations.

8. Name the uses that are made of a *foot ruler* and a *yard-stick.* What units of measure are used for measuring long distances?

9. Give orally the table used for measuring *distance;* then write it with proper abbreviations.

10. Write the names of the different measures, and write each of the following under its proper measure: milk, oil, vinegar, spices, oats, hay, molasses, sugar, rice, cloth, coal, potatoes, the length of the blackboard, the width of a page of your book.

Written Work

Changing to a lower denomination in denominate numbers, as 1 pk. to 8 qt., is just the same in principle as changing $\frac{1}{4}$ to $\frac{4}{16}$.

11. Change $1\frac{1}{2}$ pecks to quarts.

$$\textbf{1 pk.} = \textbf{8 qt.}$$
$$\mathbf{1\tfrac{1}{2} \ pk.} = \mathbf{1\tfrac{1}{2} \times 8 \ qt., \ or \ 12 \ qt.}$$

Copy, and fill the blanks:

12.	$3\frac{1}{2}$ pk. = —— qt.	**27.**	$1\frac{1}{2}$ min.	= —— sec.
13.	1 bu. = —— pk.	**28.**	$1\frac{3}{4}$ gal.	= —— qt.
14.	$1\frac{3}{4}$ bu. = —— pk.	**29.**	$3\frac{1}{4}$ pk.	= —— qt.
15.	16 qt. = —— pt.	**30.**	18 sq. yd.	= —— sq. ft.
16.	$3\frac{1}{2}$ qt. = —— pt.	**31.**	$8\frac{1}{4}$ yd.	= —— ft.
17.	$8\frac{1}{4}$ ft. = —— in.	**32.**	$2\frac{1}{4}$ sq. ft.	= —— sq. in.
18.	6 yd. = —— ft.	**33.**	$\frac{7}{8}$ pk.	= —— qt.
19.	3 gal. = —— qt.	**34.**	$\frac{3}{4}$ pk.	= —— pt.
20.	$5\frac{1}{2}$ gal. = —— qt.	**35.**	5 lb.	= —— oz.
21.	$6\frac{1}{2}$ lb. = —— oz.	**36.**	$3\frac{1}{2}$ yd.	= —— in.
22.	$6\frac{3}{4}$ lb. = —— oz.	**37.**	$1\frac{3}{4}$ bu.	= —— pt.
23.	$1\frac{3}{4}$ bu. = —— qt.	**38.**	$\frac{3}{4}$ yd.	= —— ft.
24.	$1\frac{1}{4}$ da. = —— hr.	**39.**	$1\frac{7}{8}$ rd.	= —— ft.
25.	$\frac{3}{4}$ pk. = —— qt.	**40.**	$1\frac{1}{4}$ mi.	= —— rd.
26.	$1\frac{3}{4}$ T. = —— lb.	**41.**	$2\frac{1}{4}$ sq. ft.	= —— sq. in.

42. Change 36 feet to yards.

$$1 \text{ ft.} = \tfrac{1}{3} \text{ yd.} \quad 36 \text{ ft.} = \tfrac{36}{3} \text{ yd., or } 12 \text{ yd.}$$

Change :

43. 96 ft. to yards.	**58.** 129 ft. to yards.
44. 36 pt. to gallons.	**59.** 328 qt. to pecks.
45. 24 pk. to bushels.	**60.** 4000 lb. to tons.
46. 128 oz. to pounds.	**61.** 320 oz. to pounds
47. 32 qt. to gallons.	**62.** 54 in. to feet.
48. 48 hr. to days.	**63.** 640 pt. to pecks.
49. 168 gi. to quarts.	**64.** 224 qt. to bushels.
50. 960 pk. to bushels.	**65.** 66 ft. to rods.
51. 540 in. to yards.	**66.** 4160 rd. to miles.
52. 15,840 ft. to miles.	**67.** 5000 lb. to tons.
53. 240 oz. to pounds.	**68.** 1500 sec. to minutes.
54. 28,000 lb. to tons.	**69.** 147 da. to weeks.
55. 1440 min. to hours.	**70.** 2880 min. to days.
56. 7200 sec. to hours.	**71.** 864 in. to yards.
57. 55 yd. to rods.	**72.** 608 qt. to bushels.

73. James sold 8 qt. and 1 pt. of milk on Tuesday. How many pints did he sell?

8 qt.	$= 8 \times 2$ pt. $= 16$ pt.	Since 1 qt. = 2 pt., 8 qt. = 8 × 2 pt.,
1 pt.	$= 1$ pt.	or 16 pt.
8 qt. 1 pt.	$= 17$ pt.	Therefore 8 qt. 1 pt. = 17 pt.

74. Henry picked 1 bu. 3 pk. of apples, and sold them at 25 ¢ a peck. How much did he receive for them?

75. Mary picked 1 bu. 1 pk. of cranberries, and sold them at 8 ¢ a quart. How much did she receive for them?

76. William worked 3 hr. and 20 min. each day at 10 ¢ an hour. How much did he earn in 6 days?

77. Nell hemstitched $1\frac{3}{4}$ doz. handkerchiefs at 3 ¢ apiece. How much did she receive for her work?

78. George and Donald bought 1 bu. 3 pk. of potatoes at $1.52 a bushel, and planted them in the spring. In the fall they sold 60 bu. at 25 ¢ a half peck. How much did they realize from the sale of these potatoes?

79. Mary helped her neighbor an hour and 40 minutes each day, for 10 ¢ an hour. How much did she earn in 6 days?

80. Walter and Frank picked chestnuts on Saturday. Frank picked 7 qt. and Walter picked 5 qt. If they sold them at 5 ¢ a pint, how much did they get for them?

81. Mr. Smith fed his horse 4 qt. of oats three times a day. At 80 ¢ a bushel how much were the oats worth in a month of 30 days?

82. A boy earned 20 ¢ an hour. How much did he earn at that rate in 3 hr. and 45 min.?

83. Play that you are picking fruit, such as plums, peaches, apples, etc., and selling it at so much per quart, peck, etc.

84. How much was gained in buying a bushel of apples at $1.00 and selling the apples at 20 ¢ a half peck?

85. How much was gained in buying a bushel of onions at $2.10 a bushel and selling the onions at 5 ¢ a pound (57 lb. = 1 bu.)?

86. James sold from his school garden $\frac{1}{2}$ a bushel of peas at 15 ¢ a quart, 7 qt. of string beans at 15 ¢ a quart, and a quarter peck of lima beans at 7 ¢ a quart. How much did he receive in all for these vegetables?

87. At 8 ¢ a pint, find the cost of 6 gal. 1 pt. of milk.

88. At 10 ¢ a quart, find the cost of 4 bu. 2 pk. of beans.

89. At 4 ¢ an ounce, find the cost of 3 lb. 3 oz. of ginger.

90. At 36 ¢ a pound, find the cost of 29 lb. of nut butter.

SHORT METHODS OF SOLVING PROBLEMS

First interpret each problem; *second*, estimate the result; *third*, give the shortest method of solution.

1. If 2 lb. of butter cost 90 ¢, how much do 5 lb. cost?

SOLUTION. 5 lb. cost $\frac{5}{2}$ of, or $2\frac{1}{2}$ times, the cost of 2 lb.
$$2\tfrac{1}{2} \times 90 \text{¢} = \$2.25$$

2. When 5 tablets cost 50 ¢, how much do 10 tablets cost?

3. If 2 pairs of gloves cost $1.50, how much do 4 pairs cost? 8 pairs? 6 pairs?

4. When 2 pencils cost 5 ¢, how much do 10 pencils cost? 6 pencils? 12 pencils?

5. When 3 lb. of butter cost $1.20, how much do 6 lb. cost?

6. If 6 hats cost $9.00, how much do 24 hats cost?

7. A train runs 52 mi. in 2 hr. How far does it run in 22 hr.? in 14 hr.? in 12 hr.?

8. If 4 sets of books cost $74, how much do 2 sets cost? 16 sets? 8 sets?

SUGGESTION.   2 sets = $\frac{1}{2}$ of 4 sets; 16 sets = $\frac{16}{4}$ of 4 sets, or 4 × 4 sets.

9. When 2 cans of corn cost 25 ¢, how much do 10 cans cost? 14 cans? 20 cans?

10. When 2 bolts of ribbon cost 10 ¢, how many bolts can be bought for 25 ¢? for 45 ¢?

11. Edith knits 3 rows of a sock in 5 min. and there are 9 rows to an inch. How long does it take her to knit 8 inches?

SUGGESTION. Since 9 rows = 3 × 3 rows, how many minutes, or what part of an hour, does it take for 1 in.? for 8 in.?

12. If 5 hanks of wool can be bought for $4, how many can be bought for $8? for $12? for $18?

13. If 5 boxes of berries cost 35¢, how much do 15 boxes cost? 25 boxes? 9 boxes?

SUGGESTION. 9 boxes are 1 less than 10 boxes.

14. If 5 yd. of serge cost $6.50, how much do 9 yd. cost? 15 yd.? 20 yd.? 11 yd.?

15. $3\frac{1}{2}$ lb. beefsteak cost $1.54. At that rate find the cost of 28 lb.

SUGGESTION. $3\frac{1}{2}$ lb. = $\frac{7}{2}$ lb.　28 lb. = $\frac{56}{2}$ lb.　$\frac{56}{2}$ = how many times $\frac{7}{2}$?

16. A workman's wages for $3\frac{1}{2}$ hr. are $2.80. At that rate find his wages for 42 hr.

17. $\frac{1}{6}$ of a man's profits for a year is $219. Find his profits.

18. $\frac{3}{5}$ of a ton of coal cost $5.40. At that rate find the cost of 1 ton.

19. $1\frac{1}{4}$ lb. veal cost 40¢. At that rate find the cost of $12\frac{1}{2}$ lb.

SOLUTION. $1\frac{1}{4}$ lb. = $\frac{5}{4}$ lb.; $12\frac{1}{2}$ lb. = $\frac{50}{4}$ lb.　$\frac{50}{5}$ = 10; 10 × 40¢ = $4.

20. $3\frac{1}{2}$ lb. raisins cost 49¢. Find the cost of 20 lb. at the same rate.

21. John's profits the first three months of the year are $300. Find his profits at that rate for $\frac{3}{4}$ of a year.

22. If 2 desks cost $15, how much do 8 desks cost? 10 desks? 12 desks?

23. When 3 yd. of ribbon can be bought for $1.50, how many yards can be bought for $4.50? $6? $12?

24. When 8 yd. of velvet cost $24, how much does $\frac{1}{4}$ yd. cost?

25. A man walked $11\frac{1}{4}$ mi. in 3 hr. At the same rate, how far would he walk in 6 hr.?

26. If 3 acres of land cost $250, how much will 12 acres cost?

27 If $1\frac{1}{2}$ acres yield 120 bu. of potatoes, how many bushels will 3 acres yield at the same rate?

28. At the rate of 40 ¢ a dozen, how much will 9 lemons cost? How much will $1\frac{1}{2}$ doz. cost? 3 doz.?

29. If 6 collars cost $2.10, how much will 24 cost?

30. Find the cost of the following articles: 12 yd. ribbon @ 25 ¢, 8 yd. lace @ $12\frac{1}{2}$ ¢, 10 yd. dimity @ 20 ¢.

SUGGESTION. 25 ¢ = $\frac{1}{4}$; $12\frac{1}{2}$ ¢ = $\frac{1}{8}$; 20 ¢ = $\frac{1}{5}$.

31. Find the cost of 6 lb. sugar @ $8\frac{1}{3}$ ¢, 3 lb. tea @ $33\frac{1}{3}$ ¢, and 8 lb. grapes @ $12\frac{1}{2}$ ¢.

32. How many pounds of coffee can be bought for $40 at 25 ¢ a pound?

SOLUTION. $40 ÷ $\frac{1}{4}$ = 160, number of pounds.

33. How many yards of ribbon, at $12\frac{1}{2}$ ¢ a yard, can be bought for $2?

34. How many yards of silk, at $1.25 a yard, can be bought for $10?

SUGGESTION. $1.25 = $\frac{5}{4}$; $10 ÷ $\frac{5}{4}$ = ?

35. How many yards of silk, @ 1.12\frac{1}{2}$, can be bought for $9?

SUGGESTION. 1.12\frac{1}{2}$ = $\frac{9}{8}$.

36. Find the cost of $6\frac{1}{4}$ yd. of ribbon at 16 ¢ a yard.

SOLUTION. $6\frac{1}{4}$ yd. = $\frac{1}{16}$ of 100 yd.; $100 × $.16 = $16; $\frac{1}{16}$ of $16 = $1.

37. Find the cost of $12\frac{1}{2}$ lb. of butter at 48 ¢ a pound.

Find the amount of the following bills:

38. 4 yd. lace @ $12\frac{1}{2}$ ¢.

39. $12\frac{1}{2}$ lb. sugar @ 8 ¢.

40. 16 yd. ribbon @ $12\frac{1}{2}$ ¢.

41. $6\frac{1}{4}$ lb. prunes @ 12 ¢.

42. 8 lb. butter @ 50 ¢.

43. 24 tickets @ 25 ¢.

DECIMALS

DECIMAL PARTS OF A DOLLAR

Oral Work

1. How many dimes equal a dollar? Then what part of a dollar is a dime?

2. How many cents equal a dollar? Then what part of a dollar is a cent?

3. Ten mills equal one cent. How many mills equal a dollar? Then what part of a dollar is a mill?

Mills are not coined, but are used for exactness in computations.

When we think of a dollar as dimes, it has 10 equal parts; when we think of a dollar as cents, it has 100 equal parts; when we think of a dollar as mills, it has 1000 equal parts. A mill is $\frac{1}{10}$ of a cent; a cent $\frac{1}{10}$ of a dime; and a dime $\frac{1}{10}$ of a dollar.

This division of a dollar into tenths, hundredths, thousandths, etc., we call **decimal parts of a dollar.**

The point separating dollars and cents is called the **decimal point.** Thus, in $2.75 the point separates 2 dollars from 75 cents.

4. What decimal part of a dollar are 5 dimes? 6 dimes?

5. What decimal part of a dollar are 5 cents? 8 cents?

The first place to the right of the decimal point is occupied by *dimes* or *tenths* of a dollar; the second place, by *cents* or *hundredths* of a dollar; the third place, by *mills* or *thousandths* of a dollar.

Dimes, cents, and mills can always be written as decimal parts of a dollar. Thus, 8 dimes, 5 cents = $.85; 2 mills = $.002.

READING AND WRITING DECIMALS

One tenth may be written .1 as well as $\frac{1}{10}$; one **hundredth** may be written .01 as well as $\frac{1}{100}$; and one **thousandth may be** written .001 as well as $\frac{1}{1000}$.

1. Read: .8 ft., .5 lb., .7 pk., .5 ft., .7 mi.

A period placed before tenths is called a **decimal point.**

Any number of 10ths, 100ths, 1000ths, etc., of a unit **is** called a **decimal fraction.** When expressed after a decimal point and without a written denominator it is usually called **a decimal.**

The first place to the right of the decimal point is **called tenths**; the second place, **hundredths**; and the third **place, thousandths.**

2. In 5.55, the 5 hundredths is what part of the 5 **tenths?** the 5 tenths is what part of the 5 units?

3. Name the following parts of a dollar, first as **tenths, hundredths,** and **thousandths**; then as cents and **mills:** $.655, $.054, $.005, $.50, $.75, $.80, $.705, $.256.

4. Write in figures: six dollars and five cents; ten **dollars and fifty cents**; three mills; five cents; five mills.

5. Read; then change to cents. Thus, $3.85 = 385¢. $2.05; $.70; $0.07; $7.42; $8.00; $.75; $3.50.

6. Change to dollars and cents: 55¢; 85¢; 870¢; 1002¢.

7. Write: eighty-five cents; nine dollars and two **cents;** twenty-two dollars; nine hundred dollars and six **cents.**

8. Write: eighty-seven cents five mills

In any number, whether a whole number or a decimal, **the** *value of a figure in any place is* $\frac{1}{10}$ *of the value of the same figure standing one place to the left.*

9. What is the largest decimal division of a unit? the second largest? the third largest?

10. $.06 = \frac{?}{100} = \frac{?}{1000}$

11. $.25 = \frac{?}{100} = \frac{?}{1000}$

12. $.05 = \frac{?}{100} = \frac{?}{1000}$
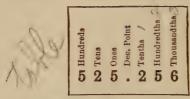
13. $.9 = \frac{?}{10} = \frac{?}{100} = \frac{?}{1000}$

14. $.025 = \frac{?}{1000} = \frac{?}{10000}$

15. $.349 = \frac{?}{1000} = \frac{?}{10000}$

Observe that a decimal is always less than a unit.

Hundreds	Tens	Ones	Dec. Point	Tenths	Hundredths	Thousandths
5	2	5	.	2	5	6

This number is read "five hundred twenty-five *and* two hundred fifty-six thousandths."

As the first decimal division of a unit is tenths, we always begin to enumerate the decimal at tenths' place; thus:

tenths	hundredths	thousandths
.0	0	5

16. Where do we begin to enumerate whole numbers?

17. Read: .25, .025, 25.005, 7.05, 321.1, 100.001, .001.

18. Write as decimals: $\frac{5}{10}$, $\frac{7}{100}$, $\frac{25}{1000}$, $\frac{1}{10}$, $\frac{15}{1000}$, $\frac{2}{1000}$, $26\frac{6}{1000}$, $100\frac{1}{1000}$, $1\frac{8}{10}$, $70\frac{105}{1000}$.

Write as decimals:

19. Two thousandths.

20. Two and two thousandths.

21. Five hundredths.

22. Two hundred and two thousandths.

23. Two hundred two thousandths.

24. Three and five tenths.

25. Seventy-five hundredths

26. Five hundred and five thousandths.

REDUCTION OF DECIMALS

How to change decimals to common fractions.

1. Change .5 to a common fraction. $.5 = \frac{5}{10} = \frac{1}{2}.$

2. Express as a common fraction, .25, .45, .025.

Written Work

1. Change .875 to a common fraction in its lowest terms.

$.875 = \frac{875}{1000} = \frac{7}{8}$ Expressed in the form of a common fraction .875 = $\frac{875}{1000}$. By dividing both the numerator and the denominator of $\frac{875}{1000}$ first by 25 and then by 5, we reduce it to its lowest terms, $\frac{7}{8}$.

To change a decimal to a common fraction, write the decimal omitting the decimal point, place the decimal denominator beneath the numerator, and change the fraction to its lowest terms.

Change to common fractions in their lowest terms:

2. .15	**4.** .9	**6.** .75	**8.** .125
3. .825	**5.** .325	**7.** .025	**9.** .425

10. Memorize the following equivalents:

$\frac{1}{2} = .50$	$\frac{3}{4} = .75$	$\frac{4}{5} = .80$	$\frac{5}{8} = .62\frac{1}{2}$
$\frac{1}{3} = .33\frac{1}{3}$	$\frac{1}{5} = .20$	$\frac{1}{6} = .16\frac{2}{3}$	$\frac{7}{8} = .87\frac{1}{2}$
$\frac{2}{3} = .66\frac{2}{3}$	$\frac{2}{5} = .40$	$\frac{1}{8} = .12\frac{1}{2}$	$\frac{1}{12} = .08\frac{1}{3}$
$\frac{1}{4} = .25$	$\frac{3}{5} = .60$	$\frac{3}{8} = .37\frac{1}{2}$	$\frac{1}{16} = .06\frac{1}{4}$

11. Change to decimal tenths: $\frac{1}{5}, \frac{1}{2}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}.$

12. Change to decimal hundredths: $\frac{3}{4}, \frac{3}{8}, \frac{2}{3}, \frac{5}{8}, \frac{7}{8}, \frac{1}{16}, \frac{1}{12}.$

Change to common fractions in their lowest terms:

13. .45	**16.** .65	**19.** .20	**22.** .90
14. .625	**17.** .375	**20.** .60	**23.** .96
15. .85	**18.** .80	**21.** .725	**24.** .40

ADDITION OF DECIMALS

What kind of fractions can be added or subtracted?

In *adding* or *subtracting* decimals, like units must always be written under one another. Thus, to add .8, .85, and .096, write them as follows:

$$.8$$
$$.85$$
$$.096$$

Why must tenths be written *under* tenths, hundredths *under* hundredths, etc.?

A **mixed** decimal is a whole number and a decimal united. Thus, 4.05 is a mixed decimal.

Written Work

1. Add 45.5, 6.005, and 40.

45.5   Keep the decimal points in a column; also the units of the
6.005   same order. Add as in whole numbers, placing the decimal
40.   point in the sum under the points above.
91.505   Test by adding downwards.

Write from dictation. Then add and test:

2. .1 + .2 + .35 + .365 = ?   **6.** 3.04 + 4.05 + 6.099 = ?

3. .02 + .05 + .095 = ?   **7.** .007 + .009 + .0101 = ?

4. .05 + .007 + .089 = ?   **8.** 2.006 + 7.009 + 9.012 = ?

5. 1.2 + 3.4 + 4.5 = ?   **9.** .001 + .068 + .092 = ?

10. .5 + 2.5 + .003 + .60 = ?

11. .7 + 1.07 + 1.007 = ?

12. .07 + 5.081 + .001 + .90 = ?

13. .1 + 2 + .75 + 8.006 = ?

14. 3 + .7 + 5.02 + 7.008 = ?

15. 5 + 8 + .3 + .05 + .006 = ?

16. .9 + .81 + .72 + 1.075 + 17.85 = ?

17. .9 + .85 + .005 + .25 + .895 = ?

Write from dictation.   Then add and test:

18.		20.		22.		24.	
	1.45		.424		.7		11.111
	3.7		8.2		.425		3.06
	10.01		6.16		18.54		.635
	2.005		19.009		7.011		.009
19.		21.		23.		25.	
	18.002		.040		89.400		.707
	2.056		48.010		75.800		101.101
	121.114		.708		761.612		96.086
	2.02		89.010		1245.000		27.409

26. Find the sum of 15.38, 9.17, 3.07, and 20.35.

27. What is the distance around a triangle whose sides are 4.75 in., 6.25 in., and 8.5 in.?

28. Helen paid $.25 for a handkerchief, $4.75 for a pair of shoes, $.45 for lace, and $3.49 for a waist. How much did they all cost?

29. A train ran the first hour 19.625 mi.; the second hour, 20.5 mi.; the third hour, 20.75 mi.; the fourth hour, 21.225 mi.   How far did it run in the four hours?

30. What is the distance around a garden that is 35.25 ft. long and 21.5 ft. wide?

31. The distance from Trent to Houston is 4.31 mi.. thence to Hastings 11.25 mi., thence to Newton 8.37 mi. How far is it from Trent to Newton?

32. Find the sum of 24.36, 108.075, 20.009, 200.001, 654.03, 549.5, and 721.25.

33. Esther canned 336.5 qt. of fruit, 285.75 qt. of vegetables, 24 qt. of soup, 31.25 qt. of meats, and 172.5 qt. of jellies.   How many quarts did she can in all?

SUBTRACTION OF DECIMALS

Oral Work

Perform the operations indicated:

1. $.5 - .3 = ?$ 4. $.008 - .002 = ?$

2. $.9 - .8 = ?$ 5. $.014 - .011 = ?$
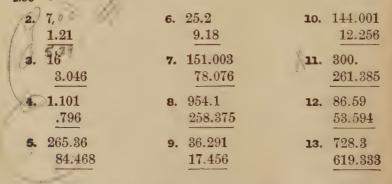
3. $15.8 - 11.7 = ?$ 6. $.08 + .09 - .12 + .04 + .02 = ?$

Written Work

1. From 16.35 subtract 11.76.

16.35   Keep the decimal points in a column. Subtract as in whole
11.76   numbers, placing the decimal point in the difference under the
4.59   points above.

2. 7. 1.21	6. 25.2 9.18	10. 144.001 12.256
3. 16 3.046	7. 151.003 78.076	11. 300. 261.385
4. 1.101 .796	8. 954.1 258.375	12. 86.59 53.594
5. 265.36 84.468	9. 36.291 17.456	13. 728.3 619.333

14. Warren had $7.50 and spent $3.75. How much had
he remaining?

15. The distance between two towns is 9 mi. After I
have walked 3.625 mi., how far have I yet to walk?

16. A man having 120 acres of land, first sold 28.75 acres,
and then 35.5 acres. How many acres had he left?

17. I paid $1.25 for car fare, $.65 for dinner, and $.90 for an umbrella. How much had I left from $5?

18. The second floor of a house was 18.78 ft. above the floor of the cellar, and the first floor was 7.92 ft. above it. How far was it from the first floor to the second?

19. Four lots measured in width 123.08 ft. Three of them were 25 ft., 32.72 ft., and 36.9 ft. wide. What was the width of the fourth lot?

20. A boy having $4.25 spent for skates $1.25. for a cap $.50, and for a hockey stick $.45. How much had he left?

21. The distance from A to E is 25.75 mi. From A to B it is 3.25 mi.; from B to C, 8.5 mi.; from C to D, 7.25 mi. What is the distance from D to E?

22. A farmer owned 18.125 acres of land. He sold 3.25 acres to his brother, 4.5 acres to his son, 2.75 acres to his cousin, and 2.5 acres to a neighbor. How many acres had he left?

23. A fisherman brought home four trout weighing 1.25 lb., .875 lb., 1.375 lb., and 1.125 lb. How much less than 5 lb. did they all weigh?

24. A farmer cut 40 tons of hay. He sold 6.85 tons to one man, and 5.50 tons to another. He fed the rest to his stock. How many tons did he feed to his stock?

25. From a heap of coal in a coal yard containing 75 tons, four truck loads were taken containing 4.75 tons, 3.5 tons, 2.25 tons, and 4.5 tons. How much remained in the heap?

26. A man having $20 spent $4.75 for board, $2.80 for a room, $.88 for laundry, $1.75 for a pair of gloves, and $3.50 for a pair of shoes. How much had he left?

27. A merchant purchased the following: coffee, $15.25; sugar, $18.35; cakes, $11.65; fruit, $27.75; and canned corn, $8.45. How much less than $120 was the amount of his bill?

MULTIPLICATION OF DECIMALS

How to multiply a decimal by an integer or an integer by a decimal.

Oral Work

1. How much is $5 \times .3$? $.3 \times 5$?

SOLUTION. $5 \times .3 = 5 \times \frac{3}{10} = \frac{15}{10} = 1.5.$
$.3 \times 5 = \frac{3}{10} \times 5 = \frac{15}{10} = 1.5.$

2. Find $4 \times .03$; $.03 \times 4$.

3. Find $6 \times .003$; $.003 \times 6$.

4. Find 6×1.3; 1.3×6.

SOLUTION. $6 \times 1.3 = 6 \times 1\frac{3}{10} = 7\frac{8}{10} = 7.8.$
$1.3 \times 6 = 1\frac{3}{10} \times 6 = 7\frac{8}{10} = 7.8.$

Notice that in each case when the multiplier is an integer, the product contains the same number of decimal places as the multiplicand; when the multiplicand is an integer, the product contains the same number of places as the multiplier.

In multiplying a decimal by an integer, the product contains the same number of decimal places as the multiplicand.

In multiplying an integer by a decimal, the product contains the same number of decimal places as the multiplier.

Written Work

1. Multiply 5.75 by 6.

  5.75 6×5 hundredths = 30 hundredths, or 3 tenths and **no**
    6   hundredths.   Write zero in hundredths' place and carry **the**
  34.50 three tenths.

        6×7 tenths = 42 tenths; 42 tenths + 3 tenths = **45** tenths, or 4 units and 5 tenths.   Write 5 in tenths' place and carry **the 4 units.**   Write the decimal point.

6×5 units = 30 units; 30 units + 4 units = 34 units.

2. Multiply 575 by .026.

```
  575
  .026
 3 450
 11 50
14.950
```
Multiply as in integers. As there are 3 decimal places in the multiplier, point off 3 places from the right in the product.

3. Multiply 623 by 1.35.

```
   623
  1.35
  31 15
  186 9
 623
841.05
```
As there are 2 decimal places in the multiplier, point off 2 places from the right in the product.

Find the products :

4.	8 × .015	**15.**	.9 × 117	**26.**	.066 × 3455
5.	9 × .005	**16.**	.02 × 112	**27.**	.467 × 2639
6.	18 × .17	**17.**	.64 × 236	**28.**	.095 × 7148
7.	25 × .207	**18.**	.004 × 149	**29.**	.081 × 3236
8.	44 × 5.6	**19.**	3.04 × 415	**30.**	234.17 × 1099
9.	65 × 7.5	**20.**	10.34 × 308	**31.**	4.022 × 1402
10.	73 × 8.4	**21.**	.005 × 718	**32.**	.05 × 2472
11.	117 × 9.3	**22.**	.024 × 122	**33.**	5.625 × 3122
12.	208 × 6.8	**23.**	.015 × 215	**34.**	.003 × 4144
13.	306 × 5.8	**24.**	.007 × 283	**35.**	1.02 × 596
14.	425 × 7.2	**25.**	2.042 × 212	**36.**	4.003 × 3407

37. How much do 7 arithmetics cost at $.82 apiece ?

38. How many feet are there in .375 mi.?

39. How many square inches are there in .75 sq. ft.?

40. At $.35 each, how much do 24 books cost?

41. A rod equals 16.5 ft. How many feet equal 29 **rd.**?

42. At a Fresh Air Home it costs $.933 for a week for each child. How much money must a man contribute if he wishes to give a two weeks' outing to each of 25 poor children?

43. When 1 lb. of cream cheese costs $.355, how much do 64 lb. cost?

44. How many pounds are there in .875 ton?

45. An automobile averages 17.75 mi. an hour. How far does it travel in 14 hr.?

46. Multiply by 10: .6, .8, .84, .86, .76, .65, .54, .005.

47. Multiply 500 by: .06, .04, .005, .42, .47, 56.7, .478.

48. Multiply by 100: .6, .8, .84, .95, .86, .76, .06, .04, .005, 4.23, 56.7, .478, 8.6, 9.8, .594, 5.94, 59.4.

Find the cost of:

49. 24 lb. @ $.125

50. 27 yd. @ $.165

51. 56 bu. @ $.375

52. .875 ft. @ $4

53. .375 yd. @ $2

54. .125 T. @ $4

55. 64 bbl. @ $7.50

56. 16 ft. @ $18.75

57. 45 lb. @ $.052

58. 66 gal. @ $.75

59. 2 bu. @ $.375

60. 1.25 doz. @ $125

61. A girl sends 27 pieces to a laundry that charges her $.75 a dozen for washing and ironing them. What is her bill?

62. If the rainfall in a certain state averages 4.62 in. month, how much is the rainfall for the year?

63. A 24-story city building averages 14.75 ft. to a story. How high is the building?

DIVISION OF DECIMALS

How to divide by an integer.

Written Work

1. Divide .84 by 4 in this way :

$$\begin{array}{r} 4\overline{)\,.84} \\ \hline .21 \end{array}$$

2. Divide 6.648 by 6 in this way :

$$\begin{array}{r} 6\overline{)\,6.648} \\ \hline 1.108 \end{array}$$

3. Divide 24.600 by 8 in this way :

$$\begin{array}{r} 8\overline{)\,24.600} \\ \hline 3.075 \end{array}$$

In dividing by an integer, the dividend is *partitioned* into equal parts. Thus, $6.9 \div 3 = \frac{1}{3}$ of 6.9, or 2.3.

Divide and test, placing a decimal point in the quotient before beginning to divide :

4. $6\overline{)\,.66}$	**7.** $7\overline{)\,.714}$	**10.** $7\overline{)\,7.847}$
5. $3\overline{)\,.96}$	**8.** $5\overline{)\,.535}$	**11.** $6\overline{)\,6.936}$
6. $8\overline{)\,.808}$	**9.** $4\overline{)\,.848}$	**12.** $8\overline{)\,8.896}$

13. Explain why adding *zeros* to the right of a decimal does not change its value. Thus, $.8 = .80, .05 = .050$.

It is sometimes necessary to add zeros to the right of the dividend to complete the division.

14. Divide .12 by 5.

$$5\overline{)\,.12} = 5\overline{)\,.120}$$
$$.024$$

15. Divide 39.25 by 25.   **16.** Divide 12.648 by 24.

$$\begin{array}{r} 1.57 \\ 25\overline{)\,39.25} \\ 25 \\ \hline 142 \\ 125 \\ \hline 175 \\ 175 \\ \hline \end{array} \qquad \begin{array}{r} .527 \\ 24\overline{)\,12.648} \\ 12\ 0 \\ \hline 64 \\ 48 \\ \hline 168 \\ 168 \\ \hline \end{array}$$

Ex. 15. How many times is 25 contained in 39? in 14.2? in 1.75?

Divide as in the division of integers, placing the decimal point in the quotient *directly above* the point in the dividend.

Ex. 16. Since 24 is larger than 12.648, the quotient must be a decimal.

17. Divide .1275 by 25.

$$\begin{array}{r} .0051 \\ 25)\overline{.1275} \\ 125 \\ \hline 25 \\ 25 \\ \hline \end{array}$$

18. Divide 192.96 by 16.

$$\begin{array}{r} 12.06 \\ 16)\overline{192.96} \\ 16 \\ \hline 32 \\ 32 \\ \hline 96 \\ 96 \\ \hline \end{array}$$

In Ex. 17, two zeros must follow the decimal point in the quotient, since 25 is not contained in 1 or in 12.

In Ex. 18, one zero must follow the decimal point, since 16 is not contained in the third partial dividend, 9.

Place a decimal point directly above or below the decimal point in the dividend, before beginning to divide ; then divide as in the division of integers.

Find the quotients and test:

19. $69.92 \div 23$	**37.** $283.88 \div 47$	**55.** $.018 \div 12$
20. $29.54 \div 14$	**38.** $6.497 \div 73$	**56.** $.546 \div 21$
21. $195.2 \div 32$	**39.** $16.150 \div 34$	**57.** $.003 \div 10$
22. $401.4 \div 18$	**40.** $55.660 \div 92$	**58.** $.368 \div 16$
23. $3.434 \div 34$	**41.** $5.460 \div 84$	**59.** $1.625 \div 25$
24. $156.4 \div 46$	**42.** $16.272 \div 18$	**60.** $24.36 \div 12$
25. $1.014 \div 26$	**43.** $1.25 \div 5$	**61.** $172.8 \div 24$
26. $5.084 \div 41$	**44.** $.64 \div 16$	**62.** $14.76 \div 41$
27. $.945 \div 35$	**45.** $.02 \div 40$	**63.** $1.105 \div 65$
28. $60.32 \div 52$	**46.** $7.5 \div 60$	**64.** $2.07 \div 46$
29. $.968 \div 44$	**47.** $4.9 \div 140$	**65.** $31.2 \div 36$
30. $.828 \div 23$	**48.** $.01 \div 100$	**66.** $2.31 \div 55$
31. $5.18 \div 37$	**49.** $.05 \div 500$	**67.** $1.17 \div 65$
32. $8.33 \div 49$	**50.** $.03 \div 100$	**68.** $16.5 \div 22$
33. $1.566 \div 54$	**51.** $.027 \div 18$	**69.** $273.35 \div 35$
34. $2.144 \div 67$	**52.** $4.44 \div 50$	**70.** $31.288 \div 48$
35. $8.437 \div 59$	**53.** $125 \div 50$	**71.** $137.95 \div 31$
36. $233.32 \div 38$	**54.** $9.66 \div 46$	**72.** $106.32 \div 24$

Find the quotients and test:

73. $4\overline{).3}$ **74.** $8\overline{).6}$ **75.** $6\overline{)6.27}$ **76.** $5\overline{)5.28}$

77. $1.6 \div 2$ **85.** $1.024 \div 6$ **93.** $3.108 \div 3$

78. $.9 \div 3$ **86.** $.102 \div 3$ **94.** $.08 \div 2$

79. $.12 \div 6$ **87.** $.039 \div 13$ **95.** $1.125 \div 5$

80. $.005 \div 5$ **88.** $1.44 \div 12$ **96.** $4.16 \div 4$

81. $.008 \div 4$ **89.** $3.015 \div 3$ **97.** $.35 \div 7$

82. $2.7 \div 9$ **90.** $.063 \div 7$ **98.** $.077 \div 11$

83. $1.2 \div 4$ **91.** $9.04 \div 8$ **99.** $.022 \div 2$

84. $.24 \div 8$ **92.** $.72 \div 10$ **100.** $.036 \div 6$

101. A piece of ground containing 1.565 A. was divided into 4 lots. How much ground was there in each lot?

102. A piece of property was sold for $1565.76. It belonged in equal shares to 3 sisters. How much did each receive?

103. 4.9 mi. of graded road were built in Mercer County this year. Mr. Ames had a contract for $\frac{1}{4}$ of the distance. Find the distance Mr. Ames built.

104. Four boys raised 1032.64 bu. of corn in one season. What was the average for each boy?

In Ex. 105–109, find results to mills.

105. It cost $18.56 to produce 124 bu. of corn. Find the average cost per bushel.

106. A crop of 6000 lb. of onions was raised at a cost of $24.45. Find the average cost per pound.

107. It cost $4.63 to raise 1077 lb. of tomatoes. What was the average cost per pound?

108. If 294 qt. of vegetables were canned at a cost of $13.65, what was the cost per quart?

109. When 207 bu. of potatoes were raised at a cost of $44.20, what was the cost per bushel?

REDUCTION TO DECIMALS

How to change common fractions to decimals.

Oral Work

1. Change $\frac{1}{5}$ to tenths and express the result as a decimal. Thus, $\frac{1}{5} = \frac{2}{10}$, or .2.

2. Change $\frac{1}{2}$ to tenths; to hundredths.

3. Change $\frac{1}{4}$ to hundredths.

4. Change $\frac{1}{8}$ to thousandths.

Written Work

1. Divide 12 by 16.

$12 \div 16 = 12.00 \div 16.$

$$\begin{array}{r} .75 \\ 16\overline{)12.00} \\ 11\,2 \\ \hline 80 \\ 80 \\ \hline \end{array}$$

12 is equal to 12.00, which divided by 16 equals .75.

A decimal point must be placed after an integer before zeros are annexed.

Find the quotients:

2. $20 \div 75$	**6.** $44 \div 99$	**10.** $605 \div 1210$
3. $60 \div 150$	**7.** $110 \div 220$	**11.** $513 \div 2052$
4. $24 \div 228$	**8.** $340 \div 1700$	**12.** $208 \div 1664$
5. $30 \div 375$	**9.** $510 \div 1020$	**13.** $944 \div 1888$

14. Change $\frac{3}{4}$ to a decimal.

$$\frac{3}{4} = 3 \div 4 = 4\overline{)3.00}^{\;.75}$$

Since a fraction may be regarded as an expression of division (p. 93), $\frac{3}{4} = 3 \div 4$. Annex zeros and divide as above. The result is .75.

$$\text{Test. } .75 = \frac{75}{100}, \text{ or } \frac{3}{4}.$$

Change to decimals:

15. $\frac{1}{5}$	**17.** $\frac{3}{5}$	**19.** $\frac{7}{8}$	**21.** $\frac{1}{16}$
16. $\frac{3}{8}$	**18.** $\frac{4}{8}$	**20.** $\frac{3}{5}$	**22.** $\frac{5}{16}$

23. Change $\frac{4}{9}$ to a decimal.

$9\overline{)4.000}$
$.444\frac{4}{9}$

In changing $\frac{4}{9}$ to a decimal it is evident that the divisor is not contained in the dividend without a remainder. The quotient may be indicated with a fraction, or a + sign may take the place of the fraction to show an undivided remainder.

$9\overline{)4.000}$
$.444^+.$

A common fraction is changed to an equivalent decimal by placing a decimal point after ones' place in the numerator and dividing by the denominator.

Change to decimals, and test:

1. $\frac{1}{3}$	**6.** $\frac{5}{12}$	**11.** $\frac{9}{16}$	**16.** $\frac{11}{12}$
2. $\frac{1}{6}$	**7.** $\frac{3}{7}$	**12.** $\frac{11}{16}$	**17.** $\frac{11}{16}$
3. $\frac{1}{12}$	**8.** $\frac{1}{9}$	**13.** $\frac{13}{25}$	**18.** $\frac{6}{7}$
4. $\frac{2}{3}$	**9.** $\frac{7}{12}$	**14.** $\frac{11}{20}$	**19.** $\frac{5}{9}$
5. $\frac{1}{7}$	**10.** $\frac{5}{7}$	**15.** $\frac{5}{11}$	**20.** $\frac{5}{8}$

Write as mixed decimals:

21. $5\frac{1}{4}$	**31.** $3\frac{3}{4}$	**41.** $2\frac{3}{20}$	**51.** $8\frac{1}{8}$
22. $4\frac{1}{2}$	**32.** $2\frac{7}{8}$	**42.** $2\frac{5}{7}$	**52.** $12\frac{1}{2}$
23. $3\frac{1}{8}$	**33.** $2\frac{1}{7}$	**43.** $2\frac{1}{12}$	**53.** $33\frac{1}{3}$
24. $8\frac{1}{5}$	**34.** $3\frac{3}{5}$	**44.** $1\frac{7}{20}$	**54.** $37\frac{1}{2}$
25. $3\frac{2}{3}$	**35.** $8\frac{1}{9}$	**45.** $8\frac{3}{16}$	**55.** $16\frac{2}{3}$
26. $7\frac{1}{4}$	**36.** $2\frac{4}{5}$	**46.** $6\frac{2}{9}$	**56.** $62\frac{1}{2}$
27. $8\frac{1}{10}$	**37.** $2\frac{3}{7}$	**47.** $9\frac{5}{12}$	**57.** $87\frac{1}{2}$
28. $6\frac{1}{6}$	**38.** $1\frac{3}{8}$	**48.** $4\frac{5}{16}$	**58.** $31\frac{1}{4}$
29. $3\frac{2}{5}$	**39.** $1\frac{5}{8}$	**49.** $3\frac{7}{12}$	**59.** $66\frac{2}{3}$
30. $5\frac{7}{8}$	**40.** $7\frac{5}{6}$	**50.** $6\frac{7}{16}$	**60.** $83\frac{1}{3}$

MEASURING AND ESTIMATING LENGTH

Oral Work

1. Observe your foot ruler. Notice that it is first divided into inches; then into $\frac{1}{2}$ inches; then into $\frac{1}{4}$ inches, $\frac{1}{8}$ inches, and $\frac{1}{16}$ inches. These are all the divisions of the inch that are used in ordinary business.

2. Measure the lengths and the widths of your various books to the nearest eighth of an inch.

3. Measure various objects in the schoolroom and express their lengths and widths in feet and fractions of a foot.

4. Observe the yardstick. Notice that it is divided in the same manner as the foot ruler. How many feet equal 1 yard? 1 foot is what part of 1 yard? 2 feet are what part of 1 yard?

5. How many feet equal 1 rod? Measure a rod on the blackboard with a yardstick. How many rods equal 1 mile?

6. Measure the length and the width of a playground in yards. Determine the length and the width of the playground in rods in two different ways.

7. How many rods equal $1\frac{1}{2}$ mi.?

8. Secure a board 1 rd. in length and **divide** it into feet and fractions of a foot. With this board, measure 20 rd. from the schoolhouse and set a post.
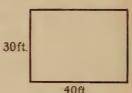
NOTE. Pace off certain distances until you gain accuracy in estimating the length of your own steps. Secure a 50-foot tapeline and measure or estimate the distance you live from the schoolhouse.

In the city measure certain city blocks in both yards and rods. Estimate by distance between the hands — 1 ft., 1 yd., $\frac{1}{2}$ yd., 1 in.

9. Estimate the length of a vacant lot in feet; then measure the length and compare the result with your estimate.

10. Show that 320 rd. = 5280 ft.; that 1760 yd. = 5280 ft.

11. Then estimate by pacing the number of feet in a street.

12. Paul steps 2 ft. 3 in. at a step. How many feet does he travel in 240 steps?

13. Mary steps 2 ft. 2 in. at a step. How far does she live from the schoolhouse if she paces the distance in 596 steps?

14. How many feet of fence are required for a garden in the form of an oblong 26 yd. long and 12 yd. wide?

15. James lives 180 rd. from the schoolhouse. How many feet does he travel in going to and coming from school?

16. If the walk to the mineral spring is $\frac{1}{4}$ mi., how many trips each day must I make to equal 4 mi.?

DRAWING TO SCALE

1. This oblong represents a room 30 ft. wide and 40 ft. long, drawn on a scale of 40 ft. to 1 in. That is, the length of the room, 40 ft., is represented by 1 in. on the drawing and the width of the room, 30 ft., is represented by $\frac{3}{4}$ in. on the drawing. Represent the same room on a scale of 10 ft. to 1 in.; of 20 ft. to 1 in.

30 ft.

40 ft.
SCALE 40 ft. to 1 in.

2. Mary lives 50 rd. from school. Draw a line to represent this distance, on a scale of 10 rd. to 1 in.

3. The following lines are drawn on a scale of 10 ft. to 1 in. Measure the lines and find the distances represented.

a. _____

b. _____

c. _____

d. _____

e. _____

4. An oblong measures $3\frac{1}{2}$ in. by $4\frac{1}{2}$ in. If the scale is 10 ft. to 1 in., what is its width? its length?

On the scale indicated by the heading, find what lengths or distances are represented by the following:

10 ft. to 1 in.	10 yd. to 1 in.	10 rd. to 1 in.	10 mi. to 1 in.
5. 4 in.	**8.** 3 in.	**11.** 1 in.	**14.** $1\frac{1}{2}$ in.
6. $5\frac{3}{4}$ in.	**9.** 4 in.	**12.** $1\frac{1}{2}$ in.	**15.** $2\frac{3}{4}$ in.
7. $2\frac{3}{4}$ in.	**10.** $4\frac{1}{2}$ in.	**13.** $2\frac{1}{4}$ in.	**16.** $3\frac{1}{4}$ in.

Draw oblongs on a suitable scale to represent:

17. 6 ft. by 9 ft.

18. 20 ft. by 30 ft.

19. 40 rd. by 80 rd.

20. 75 rd. by 120 rd.

21. 35 yd. by 55 yd.

22. 65 yd. by 95 yd.

23. Mary lives 15 mi. from Newark, and Susan lives 10 mi. from the same city. Draw a diagram or **graph** to represent these distances on a scale of 5 mi. to 1 in.

```
| Newark                                          Mary |
| 0                                                 15 |

| Newark                        Susan                  |
| 0                               10                   |
```

24. Henry, Frank, Martha, and Julia received the following averages for the school term : 96, 84, 90, 78. Represent their averages by lines in which 1 in. stands for 24.

25. Four boys put in the school savings bank, in one year, the following amounts : John, $48; Henry, $40; Edward, $60; and Paul, $50. Represent their savings by lines in which 1 in. stands for $24.

26. Find the scale of the map of the United States in the geography you are using, and test it by actual measurement to see whether it is correct ; also the map of your state.

27. Measure your school ground and draw a map of the surface on a suitable scale.

28. Draw, on a suitable scale, a map of your schoolroom floor, also a map of a blackboard.

29. Mr. Ronald's farm is 40 rd. by 80 rd. Show the surface on a scale of 20 rd. to 1 in.

30. The scale is frequently in fractions of an inch or of a foot. Draw a line, on a scale of 20 mi. to $\frac{1}{16}$ in., to show a distance of 3200 mi., which is about as far as from New York to San Francisco.

31. Mr. and Mrs. Jones and their three children, Mary, Martha, and Jane, are respectively 50, 40, 20, 15, and 10 yr. of age. Draw a graph to show a comparison of their ages, on a suitable scale.
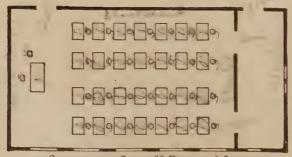
32. The maximum temperatures in a city for one week were 80, 75, 85, 70, 65, 90, and 70 degrees. Represent these temperatures by a graph, in which 1 in. stands for 20 degrees.

33. Five children attend the school term 180, 160, 170, 120, and 160 days respectively. Show their attendance by a graph in which 1 in. stands for 40 days.

34. Four children have put in the school savings bank $40, $48, $30, and $20. Show a comparison of their savings by a graph in which 1 in. stands for $8.

35. The lines below are drawn on a scale of 10 mi. to 1 in. How many miles does *AB* represent? *CD? EF? GH?*

A̲_____B

C̲_____D

E̲_____F

G̲_____H

36. The following plan is $1\frac{1}{2}$ in. by $2\frac{7}{8}$ in. Find from the scale the actual width and length of the room. Find the actual width and length of each pupil's desk ($\frac{3}{16}$ in. by $\frac{1}{8}$ in.) and of the teacher's desk ($\frac{5}{16}$ in. by $\frac{1}{8}$ in.).
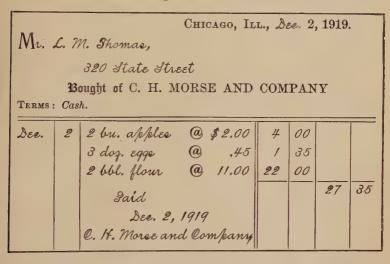
SCHOOLROOM: SCALE 16 FEET TO 1 INCH

37. Show graphically, on a suitable scale, a comparison of the length, the height, and the width of your schoolroom.

BILLS AND RECEIPTS

A **bill** is a statement of the amount owed for goods or services.

The following bill shows: (1) the *place* and the *date*, (2) who *bought* the goods; (3) who *sold* them; (4) the *name of the goods* sold and the *price* and the *amount* of each sale.

CHICAGO, ILL., *Dec.* 2, 1919.

Mr. *L. M. Thomas,*

320 *State Street*

Bought of C. H. MORSE AND COMPANY

TERMS: *Cash.*

Dec.	2	2 bu. apples @ $2.00	4	00		
		3 doz. eggs @ .45	1	35		
		2 bbl. flour @ 11.00	22	00		
					27	35
		Paid				
		Dec. 2, 1919				
		C. H. Morse and Company				

To **foot** a bill means to add the cost of all the separate articles.

A bill is **receipted** when the person to whom the amount is due writes near the bottom " Paid " or " Received payment," followed by his name.

Make bills for the following sales, using a **schoolmate's** name as purchaser, and your grocer's name as **seller**:

1. March 1, 2 lb. nut butter @ 35¢.

March 10, 6 lb. fish @ 25¢.

March 10, 3 bars soap @ 10¢.

Make out and receipt bills as suggested on page 135:

2. Jan.   10,   3 skeins yarn @ $.08.
Jan.   10,   4 papers needles @ $.05.
Jan.   10,   5 yd. ribbon @ $.50.

3. Jan.   5,   5 bu. apples @ $1.75.
Jan.   10,   3 baskets peaches @ $1.50.
Jan.   15,   12 doz. lemons @ $.40.

4. March 1,   4 spools thread @ $.05.
March 11,   6 papers pins @ $.10.
March 25,   5 cards hooks and eyes @ $.02.

5. Feb.   11,   5 lb. beans @ $.15.
Feb.   11,   3 lb. prunes @ $.15.
Feb.   11,   4 lb. fish @ $. 24.

6. May   2,   7 silver forks @ $2.00.
May   6,   3 sterling spoons @ $1.75.
May   6,   4 napkin rings @ $3.25.

7. June   5,   4 nickel sponge racks @ $2.25
June   6,   5 hairbrushes @ $2.00.
June   7,   6 nickel towel rods @ $.75.

8. June   6,   4 doz. pencils @ $.20.
June 11,   4 doz. penholders @ $.15.
June 15,   15 pens @ $.05.

9. June 17,   5 lb. knitting wool @ $3.20.
June 18,   1 knitting bag @ $1.50.
June 19,   4 knitting needles @ $.10.

10. July   8,   12 packages flaxseed @ $.05.
July   8,   3 oz. cologne @ $.35.
July   8,   5 lb. paint @ $.30.

11. July 15,   2 music cabinets @ $15.00.
   July 16,   5 rocking chairs @ $5.00.
   July 24,   3 medicine cabinets @ $3.00.

Suppose your classmates to own different stores, as, *meat shops, grocery stores, hardware stores, dry goods stores,* etc., and pretend that you are the customer. Make out proper bills for the following purchases, giving day and date of purchase. Receipt the bills.

12. September 10, 1 doz. oranges @ 40 ¢; 3 doz. bananas @ 20 ¢. September 14, 4 baskets grapes at 2 for 35 ¢. September 20, 6 qt. peanuts at 5 ¢ a pint.

13. October 4, 4 collars @ 12½ ¢; 1 necktie @ 50 ¢; 1 pair gloves @ $1.75; 1 cap @ $1.00; 1 shirt @ $1.50; 3 handkerchiefs @ 20 ¢.

14. September 10, 1 set of 6 chairs @ $13.00; 1 rocker @ $8.50. September 14, 1 bedroom suite @ $30.00; 1 mattress @ $6.00; 1 spring @ $4.50.

15. April 1, 2 hoes @ 80 ¢; 1 rake @ 60 ¢; 1 shovel @ $1.50. April 10, to repairing hose $1.90. This bill was paid May 1.

16. February 11, 3 lb. meat @ 38 ¢; 1 lb. fish @ 24 ¢. February 12, 4 lb. beans @ 15 ¢; 2 lb. country sausage @ 22 ¢. February 17, 3 lb. veal cutlets @ 30 ¢. Receipt this bill if paid February 21.

17. February 19, 1 chisel @ 40 ¢; 1 handsaw @ $1.10; 5 lb. nails @ 10 ¢. February 25, 3 boxes tacks @ 10 ¢; 1 shovel @ 80 ¢. Receipt this bill if paid March 1.

18. July 1, 1 fishing tackle @ $1.90; 1 doz. hooks @ 25 ¢; 6 fishlines @ $1.50; 1 tent @ $10; 2 skillets @ 40 ¢. Make out the bill if paid August 1.

19. August 1, 6 yd. of gingham @ 30 ¢; 2 yd. of ribbon @ 20 ¢; 1 doz. buttons @ 30 ¢; 2 spools of silk @ 12 ¢; 4 yd. of lace @ 6 ¢. Make out the bill if paid September 1.

MAKING AND SOLVING PROBLEMS

Make problems as indicated by the following directions :

1. If you live in a city or a town, make two problems about purchases for yourselves or your parents ; two about the amount you earn or save from your allowances; and two about prices of common articles at the local stores.

2. If you live in the country, make two problems about selling vegetables, fruits, etc., at near-by towns; two about purchases for your home; and two about your earnings.

3. If you keep an account in a school savings bank, make problems relating to your experiences in depositing money.

4. Plan a vacation spent in visiting a friend or in making a trip. Frame problems to include the cost of traveling, purchases made on the trip, money spent for sight-seeing, etc.

5. In solving problems, consider:

   (a) What facts are stated in the problem.
   (b) What kind of answer the question asks for.
   (c) What steps are necessary, by the shortest method, to get the required answer from the given facts.
   (d) What tests are necessary to give confidence in the accuracy of the answer.

As an aid to *accuracy*, make a *mental estimate* of the answer and compare it with the answer to your written work. If there is much difference between the two answers, you have made an error either in the estimate or in tne written work. Also form the habit of *testing* all your work by *checking* the various processes.

As an aid to *rapidity*, recall all the short methods you have learned and think of others, if possible. When the opportunity occurs, make use of the facts learned on pages 104 and 117, as well as of cancellation :

To multiply by 10, 100, 1000, etc., annex to a whole number as many zeros as there are in the multiplier; in a decimal move the decimal point to the right as many places as there are zeros in the multiplier.

To divide by 10, 100, 1000, etc., cut off the zeros or move the decimal point to the left.

To multiply by 9, multiply by 10 and subtract the multiplicand.
To multiply by 11, multiply by 10 and add the multiplicand.
To multiply by 25, multiply by 100 and divide by 4.
To divide by 25, multiply by 4 and divide by 100.

$$9 \times 643 = \begin{cases} 6430 \\ \underline{643} \\ 5787 \end{cases} \quad 11 \times 643 = \begin{cases} 6430 \\ \underline{643} \\ 7073 \end{cases} \quad \begin{array}{l} 25 \times 36 = 3600 \div 4 = 900 \\ 900 \div 25 = 36.00 = 36 \end{array}$$

6. How much cheaper is it to buy a bushel of Irish potatoes (60 lb.) for $1.59 than to buy at 5 lb. for 17 ¢ ?

Facts stated. Cost of potatoes by the bushel and in 5-pound lots.
Question. How much cheaper are they by the bushel?
Mental estimate. Cost of 60 lb. = 12 × cost of 5 lb. 12 × 17¢ = about
    $2. $2.00 − $1.60 = $.40.
Written work. 12 × $.17 = $2.04 ; $2.04 − $1.59 = $.45. This answer
    is near enough to the mental estimate, $.40, to be reasonable.

7. Find the cost of 80 T. coal @ $7.10 plus $19.95 freight.

Facts stated. Price per ton and quantity of coal; freight charges.
Question. What is the total cost?
    Cost of coal = price of 1 ton multiplied by the number of tons.
    For total cost, add cost of freight.
Mental estimate. 80 T. = $\frac{4}{5}$ of 100 T. 100 T. cost $710.
    $\frac{4}{5}$ of $710 = about $560 ; $560 + $20 = $580.
Written work. 80 T. = $\frac{4}{5}$ of 100 T. ; $\frac{4}{\cancel{5}}$ of $\overset{142}{\cancel{710}}$ = $568 ; $568 + $19.95
    = $587.95.

8. A gardener sells 4788 boxes of berries at an average price of $8\frac{1}{3}$¢ a box; and 792 boxes at $12\frac{1}{2}$¢ each. After deducting $150 for cultivation and labor, find his profit.

Facts stated. Price and quantity sold of each article; cost of raising.
Question. What is the profit?
Mental estimate. $8\frac{1}{3}$¢ = $$\frac{1}{12}$; $\frac{1}{12}$ of 4788 = about 400 ; $12\frac{1}{2}$¢ = $$\frac{1}{8}$;
    $\frac{1}{8}$ of 792 = about 100. $400 + $100 = $500 ; $500 − $150 = $350.
Written work. 4788 × $$\frac{1}{12}$ = $399 ; 792 × $$\frac{1}{8}$ = $99 ; $399 + $99 =
    $498 ; $498 − $150 = $348.

In solving these problems, use short methods whenever possible.

9. A farmer raises 80 A. of oats that average $55\frac{3}{4}$ bu. per acre. What is the value of the crop at $\$.87\frac{1}{2}$ a bushel?

10. When 1 pencil costs $12 \not\!c$, how many can you buy for $60 \not\!c$? for $96 \not\!c$?

11. Cherries are $16 \not\!c$ a pound. How many pounds can be bought for $1.44?

12. When 3 tons of coal cost $27, how much will 7 tons cost?

Why is it better in this example first to find the cost of 1 ton?

13. When 3 dozen lemons cost $90 \not\!c$, how much do 9 doz. lemons cost?

Why is it better first to find the relation of 9 doz. to 3 doz.?

14. (*a*) If 3 men earn $30 in a certain time, how much will 8 men earn in the same time at the same rate?

(*b*) If 3 men earn $30 in a certain time, how much will 9 men earn in the same time at the same rate?

What is the most economical method of working (*a*)? of working (*b*)? Why?

15. When $\frac{1}{2}$ a bushel of oats sells for $40 \not\!c$, how much do 3 bushels cost?

SUGGESTION. 3 bu. = $6 \times \frac{1}{2}$ bu.

16. How much is saved by buying a remnant of $7\frac{1}{2}$ yd. of silk for $15 instead of buying $7\frac{1}{2}$ yd. from the piece @ $2.50?

17. A 50-trip railroad ticket costs $16.70. What is the price per trip?

SUGGESTION. Since $50 = 100 \div 2$, divide mentally by 100, and multiply the result, $.167, by 2.

18. How much is saved by buying a bag of Irish potatoes containing 3 bu. for $4.20 instead of at $4 \not\!c$ a pound?

19. How much is saved by paying $1200 cash for a car instead of paying for it in 12 installments of $125 each?

20. Which is cheaper, to buy 10 yd. of 18-inch wide silk at $1 a yard or 5 yd. of 36-inch wide silk at $1.75 a yard? How much cheaper?

21. Find the gain on 50 bu. of peaches bought at $1.50 a bushel and retailed at 50 ¢ a peck.

22. Frank worked 2⅛ hr. for five days each week, and 12 hr. each Saturday. Find his earnings for 10 wk. at 12 ¢ an hour.

23. If a boy paid $1.40 a hundred for papers, and sold them for 2 ¢ apiece, how much did he gain on 300 papers?

24. In an orchard there were 144 trees; 18 were cherry trees, 36 were apple trees, and ⅘ of the remainder were peach trees. How many were peach trees?

25. Find the cost of 24,000 railroad ties at 62½ ¢ each.

26. When lead pencils are sold at $1⅖ per gross (144), find the cost of 3550 gross.

27. Find the cost of sewing buttons on 48 suits @ 3¾ ¢.

28. A contractor averaged 6⅞ rd. a day in digging a sewer. How long was the sewer if it took him 39 days to dig it?

29. A mail carrier traveled 23⅞ mi. for each delivery. How many miles did he travel in 310 deliveries?

30. An ocean steamer burned 201 5/16 T. of coal in a day. How much coal did it consume in a voyage of 7 days?

31. I bought 46 lb. of sugar @ 7 ¢, 95 lb. of coffee @ 23 ¢, and 36 doz. lemons @ 36 ¢. Find the cost of all.

32. Mr. Thomas raised 640 bu. of peaches, that were sold on an average at $1.50 a bushel basket. His baskets cost $35, and his labor $75. Find the price per bushel he realized, after payment of baskets and labor.

33. An airplane covered 225 mi. in 1 hr. 45 min. Find its rate per minute.

34. Louise paid $4 down for a $50 radio set and $2 a week until it was paid for. How many weekly installments of $2 did she pay?

35. At 34 ¢ each, how much do 189 books cost?

36. At 25 ¢ each, find the cost of 20 gross of pads.

37. If a school required an average of 497 pads of paper for 1 mo., how many pads were needed for 3 yr. of 10 mo. each?

38. Which is cheaper and how much, 3½ lb. of sugar for $.35 or 5 lb. for $.40?

39. Mother is going to move. Which will be cheaper per year and how much, a heated apartment with rent at $30 a month, or a non-heated apartment at $26, if 8 tons of coal are needed at $9 a ton?

40. Find the cost of sending a 15-word telegram at 75 ¢ for the first 10 words and 5 ¢ for each additional word.

41. How much will it cost to telegraph to the same place a night letter of 50 words, if the night rate for 50 words is the same as the day rate for 10 words?

42. A long distance telephone message cost $1.25 for the first 3 min. and $.40 for each additional minute. Find the cost of talking 17 min.

43. By moving the clock forward 1 hr. from March 31 to Oct. 27 (210 days) 1,250,000 tons of coal were saved. What was the average number of tons saved per day?

44. A family income consists of $60 a month earned by a son and $65 earned by the mother. The expenses are $20.50 for rent, $38.09 for food, $5.25 for light and fuel, $18.75 for clothing, $3.60 for car fares, and $10 for sundries. How much can the family save each month?
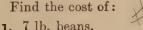
EVERYDAY USE OF NUMBERS

Daily Marketing

Mr. Adams posted the following prices in his store window Saturday morning:

Peas, 2 cans for . . . . . $ .25	Green corn, per dozen . . . $ .30
Tomatoes, per pound 12	Baked beans, per dozen cans 1.50
Beans, per pound 15	Eggs, per dozen 50
Butter, per pound 45	Eggplants, per dozen 75
Nut butter, per pound 35	Leg of lamb, per pound . .46
Sugar, per 25-pound bag . . 2.00	Ham, per pound 45
Flour, per bag 1.75	Chickens, per pound 40

Find the cost of:

1. 7 lb. beans.
2. 15 lb. butter.
3. 30 doz. eggs.
4. $4\frac{1}{2}$ lb. chicken.
5. 12 lb. butter.
6. 2 doz. cans peas.
7. $8\frac{1}{4}$ doz. corn.
8. 8 lb. tomatoes.
9. $2\frac{1}{2}$ bags flour.
10. 2 doz. cans baked beans.

11. 7 doz. eggplants.
12. 6 lb. lamb.
13. $2\frac{1}{3}$ doz. eggplants.
14. $2\frac{1}{4}$ lb. butter.
15. $1\frac{1}{2}$ lb. nut butter.
16. 8 lb. ham.
17. $1\frac{2}{3}$ doz. eggplants.
18. 3 bags sugar.
19. 9 doz. eggs.
20. $\frac{1}{2}$ doz. cans peas.

21. Make out a receipted bill for the last five articles.

143

Four H Clubs

The Four H Clubs (*Head, Heart, Hands, Health*) are organizations of boys and girls under the direction of the Department of Agriculture, for the raising of better corn, potatoes, tomatoes, pigs, poultry, etc., through proper instruction and training.

1. A corn-club boy tested three lots of seed corn. In lot 1, .75 of the kernels were good; in lot 2, .65 of the kernels; in lot 3, all were good. If the yield from seeds from lot 3 was 65 bu. per acre what would it be from lot 1? from lot 2?

2. In a year when the average yield of corn per acre was 28.2 bu., 3000 corn-club boys averaged 58 bu. to the acre. What would have been the increase in bushels on 106,000,000 acres of land if all the farmers had been as successful as these boys?

3. A corn-club boy in Alabama raised 233 bu. of corn on an acre at a cost of 19.9 ¢ a bushel. He sold the corn at 69.1 ¢ a bushel. What was his total profit?

4. One year the tomato-club girls of the South preserved 6,000,000 lb. of tomatoes at a profit of $200,000. What was the profit per pound?

5. A boy in Washington raised 871 bu. of potatoes on his acre, at a cost of $78.39. His profit was $313.56. Find the profit per bushel; the selling price per bushel.

6. A girl in Idaho belonging to a home-canning club canned 532 qt. of vegetables at a cost of $31.95. Her profit was $101.05. Find the average selling price per quart.

7. Harold's flock of ten hens gave him 822 eggs at an expense of $5.59. He sold the eggs at $.40 a dozen. Find his profit.

Pig Clubs

1. Arthur was a member of a pig club. His pig gained an average of 2.4 lb. a day for 54 da. Find the total gain in weight.

2. Arthur's pig when bought weighed 73.4 lb. and cost $12. The cost of feeding was 10 ¢ for each pound gained. What was the total profit when the live pig sold at 15 ¢ a pound?

3. Frank's pig for 54 days gained 2.25 lb. a day. How much less was its total gain than that of Arthur's pig?

4. Frank's pig when bought weighed 60.5 lb. and cost $10. The cost of feeding the pig was 8 ¢ a pound for each pound gained. Find the total profit when the live pig sold at 15 ¢ a pound.

5. When Mary's pig was 10 wk. old it weighed 29 lb. When it was 11 mo. old it weighed 450 lb. Find to thousandths the average daily gain in weight for the 264 days.

6. Philip's pig weighed 40 lb. and cost $8. It gained 1.6 lb. a day for 95 da., at a cost of 7 ¢ for each pound gained. The live pig sold at 16 ¢ a pound. Find the profit.

7. Clara's pig gained 185 lb. If the cost of the feed was $9.25, what was its cost per pound of gain?

8. A pig-club boy and his father raised pigs from the same litter. The boy's pig, at an expense of $15.60, gained 520 lb. and was sold for $62.40. The father's pig, at an expense of $5.20, gained 65 lb. and was sold for $7.80. Find the expense of each pig for each pound gained. Find also how much greater the boy's profit was than the father's.

PROBLEMS WITHOUT NUMBERS

1. How can you find the cost of a number of yards of lawn when the cost of one yard is a fractional part of a dollar?

2. How can you find the number of yards of lawn that can be purchased for a given amount when the cost of one yard is a fractional part of a dollar?

3. How can you change yards to feet? feet to yards? yards to inches?

4. How can you change pecks to quarts? pecks to bushels? bushels to quarts?

5. How can you change hours to minutes? minutes to hours? minutes to seconds?

6. If you know the price of a gallon of milk, how can you find the price of a number of quarts?

7. If you know the price of a quart of peas, how can you find the price of a peck?

8. How can you change a decimal to a common fraction?

9. How can you change a common fraction to a decimal?

10. What must be done to decimals before they can be added or subtracted?

11. How many places does the product contain when a decimal is multiplied by an integer? when an integer is multiplied by a decimal?

12. If you know the scale of a map, how can you tell the approximate distance between two places indicated on the map?

13. When you know the price of each article on a bill of goods and the total amount purchased, how can you find the total amount of the bill?

TESTS FOR ACCURACY AND SPEED

Time yourself in these exercises. Use short methods. Count any part of a cent as an additional cent.

Find the cost of:

1. 14 yd. @ 7 ¢.
2. 40 lb. @ 7¢.
3. 53 qt. @ 8½ ¢.
4. 27 lb. @ 9 ¢.
5. 71 yd. @ 12 ¢.
6. 2 pt. @ 7½ ¢.
7. 6 lb. @ 10 ¢.
8. 2 qt. @ 6¾ ¢.
9. 26 qt. @ 8 ¢.
10. 12 bu. @ 84 ¢.
11. 3¾ yd. @ 8 ¢.
12. 2¾ yd. @ 10 ¢.
13. 4¾ lb. @ 12 ¢.
14. 2⅜ yd. @ 8 ¢.
15. 6¾ lb. @ 10 ¢.
16. 5⅔ yd. @ 5 ¢.
17. 4 pk. @ 9 ¢.
18. 9½ qt. @ 8 ¢.
19. 3¾ lb. @ 15 ¢.
20. 4¾ yd. @ 50 ¢.
21. 9¾ pt. @ 8½ ¢.
22. 41¾ lb. @ 12 ¢.

23. 22⅔ yd. @ 15 ¢.
24. 24¾ yd. @ 3 ¢.
25. 41¾ yd. @ 8 ¢.
26. 59¾ yd. @ 12 ¢.
27. 25 yd. @ 12¾ ¢.
28. 24¾ qt. @ 16 ¢.
29. 90¾ lb. @ 20 ¢.
30. 22⅔ yd. @ 48 ¢.
31. 12¼ qt. @ 20 ¢.
32. 56 pt. @ 8⅛ ¢.
33. 18 qt. @ 16⅔ ¢.
34. 60 yd. @ 12½ ¢.
35. 28¾ yd. @ 50 ¢.
36. 11 qt. @ 12 ¢.
37. 16⅔ yd. @ 18 ¢.
38. 36 yd. @ 12½ ¢.
39. 18 ft. @ 33⅓ ¢.
40. 12 bu. @ 75 ¢.
41. 14 lb. @ 8 ¢.
42. 102 lb. @ 12½ ¢.
43. 120 lb. @ 25 ¢.
44. 16¾ lb. @ 9 ¢.

Find how long it takes you to get the *right answers* to each set of five examples.

I

1. $\frac{3}{4}$ of 2 in.
2. $1.56 + 2.34 + 7.05$
3. $876.3 - 489.9$
4. $15 \times .16$
5. $25.25 \div 25$

II

1. $\frac{4}{5}$ of $\frac{5}{8}$
2. $25.009 + 3.5 + 18.056$
3. $42.54 - 21.306$
4. $9 \times .018$
5. $.375 \div 15$

III

1. $16 \times 5\frac{1}{4}$
2. $3.149 + .005 + .08$
3. $563.1 - 45.875$
4. $35 \times .369$
5. $4.878 \div 18$

IV

1. $\frac{2}{3}$ of $1\frac{1}{5}$
2. $29.02 + 9.006 + .087$
3. $45 - .059$
4. 178×3.7
5. $5.025 \div 3$

V

1. $\frac{3}{4} \times \frac{4}{5} \times \frac{2}{3}$
2. $93.56 + .935 + 9.356$
3. $2.25 - .075$
4. $.45 \times 228$
5. $9.106 \div 29$

VI

1. $\frac{1}{2}$ of $\frac{4}{5}$ of $\frac{5}{8}$
2. $10.4 + .056 + .908$
3. $38.5 - 7.625$
4. $.008 \times 614$
5. $.033 \div 3$

VII

1. $3\frac{3}{4} \times 6\frac{2}{5}$
2. $163.09 + .163 + 16.3$
3. $500 - 298.999$
4. $.038 \times 2095$
5. $12 \div 75$

VIII

1. $5\frac{5}{6} \times 7\frac{1}{2}$
2. $540 + .054 + 5.4$
3. $843.9 - 625.448$
4. 4.038×2500
5. $.5 \div 8$

CHAPTER III

REVIEW — ADDITION

Written Work

1. Find the sum of 458, 589, 431.

458
589
431
1478, Sum

Test by adding downwards.

Ones. Think 10, 18 ones. **Write the 8** ones and carry the 1 ten to the tens' column.

Tens. Think 4, 12, 17 tens. **Write the 7** tens and carry the 1 hundred to the hundreds' column.

Hundreds. Think 10, 14. **Write 14** hundreds.

Add rapidly:

2.	3.	4.	5.	6.	7.
547	347	$420.85	827,451	983,122	634,541
858	928	345.78	474,297	246,893	442,211
267	655	223.32	298,743	972,341	532,891
716	849	999.99	123,456	826,107	500,030
825	785	729.15	789,034	534,891	900,765

Business men often write the sum of each column separately, and then add these sums, as in Ex. 8.   Add:

8.	9.	10.	11.	12.	13.
352	572	847	641	261	146
418	937	803	731	283	143
684	921	830	450	847	197
14	321	476	903	275	190
14	731	746	581	910	913
13	224	317	841	725	375
1454	921	567	789	234	421

Note. In these and similar exercises the children may occasionally
"run number races," to see how many correct answers each pupil can
get in a given time. Establish a class standard and let each pupil drill
until he has reached it.

Add:

14.	15.	16.	17.
456,838	465,273	769,872	754,865
789,675	989,963	898,569	937,358
594,789	652,498	457,394	673,947
596,784	798,574	734,677	495,768
854,853	585,778	872,698	345,967

18.	19.	20.	21.
436,896	896,515	428,767	967,638
794,257	786,923	295,854	384,380
234,586	968,429	468,769	548,987
234,596	385,962	498,735	625,945
643,594	956,483	876,494	645,774

22.	23.	24.	25.
847,268	765,455	$7462.85	$3729.25
695,575	437,867	4832.55	4596.85
459,786	757,677	6716.39	7767.79
583,325	293,476	4932.71	7425.06
448,639	568,728	8675.26	2589.59
548,673	343,516	9783.13	1687.23

26. Mr. Bell spent $750.65 one year for food; $524.75
for rent and car fare; $50.75 for gas; $120.95 for fuel;
$53.65 for furnishings; $375.65 for clothing; $118.75 for
labor; $50.95 for health; and $600.50 for other purposes.
Find the total expense for the year.

27. Make and solve a problem about household expenses
similar to Ex. 26.

SUBTRACTION

Written Work

1. From 843 take 385.

Minuend,	$843 = 700 + 130 + 13 =$	7 hundreds, **13** tens, **13** ones
Subtrahend,	$385 = 300 + \ 80 + \ 5 =$	3 hundreds, 8 tens, 5 ones
Difference,	$458 = 400 + \ 50 + \ 8 =$	4 hundreds, 5 tens, 8 ones

Ones. Think $13 - 5 = 8$. Write **8.**
Tens. Think $13 - 8 = 5$. Write **5.**
Hundreds. Think $7 - 3 = 4$. Write **4.**
Test. $458 + 385 = 843.$

In the **addition method** of subtraction, we find what number added to the subtrahend will make the minuend.

843   *Ones.* Think $5 + 8 = 13$. Write **8.**
385   *Tens.* Think $8 + 5 = 13$. Write **5.**
458   *Hundreds.* Think $3 + 4 = 7$. Write **4.**

NOTE. Teach only one method — whichever is preferred.

Subtract :

2.	969 824	**6.**	$ 800.20 698.29	**10.**	95,005 43,674	**14.**	54,895 32,340
3.	5700 2096	**7.**	$ 670.01 340.97	**11.**	61,070 46,581	**15.**	54,000 36,798
4.	57,050 13,856	**8.**	$ 800.00 550.75	**12.**	856,204 567,897	**16.**	2,072,500 1,987,654
5.	67,085 49,998	**9.**	$ 742.29 621.89	**13.**	759,800 463,948	**17.**	3,000,000 1,876,543

18. A man whose yearly income was $ 3000 spent $ 2345.89 one year. How much did he save ?

19. Make and solve a problem similar to problem 18.

MULTIPLICATION

Written Work

1. Multiply $1.75 by 65.

$1.75
  65

8 75   1st partial product
105 0   2d partial product
$113.75   Entire product

The 0 in the right-hand place in the second partial product is omitted. Place the decimal point in the product *directly under* the decimal point in the multiplicand.

Test by dividing the product by the multiplier.

2. $3.58		**5.** $9.08		**8.** $3.27		**11.** $4.18	
49		67		78		37	
3. $7.04		**6.** $2.25		**9.** $1.04		**12.** $6.95	
248		150		311		310	
4. $6.05		**7.** $3.28		**10.** $3.05		**13.** $8.09	
395		413		510		209	

SHORT METHODS IN MULTIPLICATION

Oral and Written Work

To multiply by 10, 100, 1000, etc., add as many zeros to the right of the multiplicand as there are zeros in the multiplier. (See also p. 138.)

To multiply by 9, multiply by 10 and subtract the multiplicand.

To multiply by 11, multiply by 10 and add the multiplicand.

To multiply by 20, 200, 2000, etc., multiply by 2 and add as many zeros to the right of the multiplicand as there are zeros in the multiplier.

To multiply by 19, multiply by 20 and subtract the multiplicand.

To multiply by 21, multiply by 20 and add the multiplicand.

To multiply by 25, multiply by 100 and divide by 4.

To multiply by 99, multiply by 100 and subtract the multiplicand.

To multiply by 125, multiply by 1000 and divide by 8.

Thus, $10 \times 35 = 350$ $9 \times 35 = 350 - 35 = 315$

$20 \times 35 = 700$ $19 \times 35 = 700 - 35 = 665$

$25 \times 35 = 3500 \div 4 = 875$ $125 \times 35 = 35000 \div 8 = 4375$

$11 \times 35 = 350 + 35 = 385$ $21 \times 35 = 700 + 35 = 735$

$99 \times 35 = 3500 - 35 = 3465$

1. Give a short method of multiplying by 24, 49, 98, 101.

Multiply Ex. 2 to 4 by 9; by 10; by 11. Multiply Ex. 5 to 7 by 19; by 21; by 25. Multiply Ex. 8 to 10 by 125; by 99; by 101. Multiply Ex. 11 to 13 by 24; by 98; by 102.

2.	110	**5.**	198	**8.**	1234	**11.**	72810
3.	256	**6.**	345	**9.**	3069	**12.**	63454
4.	327	**7.**	254	**10.**	4189	**13.**	72018

The result of taking a number twice as a factor is called **the square** of the number. Thus, the square of $8 = 8 \times 8 = 64$. This is often written $8^2 = 64$ (read "8 square = 64").

14. Commit the following **squares** to memory:

$4^2 = 16$	$8^2 = 64$	$12^2 = 144$
$5^2 = 25$	$9^2 = 81$	$13^2 = 169$
$6^2 = 36$	$10^2 = 100$	$14^2 = 196$
$7^2 = 49$	$11^2 = 121$	$15^2 = 225$

15. Build the multiplication tables through 15, and commit them to memory.

Multiply and test:

16. 6425	*a.* 245
17. 1024	*b.* 344
18. 8720	*c.* 564
19. 9652	*d.* 746
20. 8665 by	*e.* 804
21. 7894	*f.* 961
22. 8465	*g.* 869
23. 7695	*h.* 796

Form 8 groups of 8 examples each by multiplying each multiplicand by each of the multipliers, thus:

16 *a.* $245 \times 6425 = ?$
16 *b.* $344 \times 6425 = ?$
23 *h.* $796 \times 7695 = ?$

NOTE. The teacher will assign a different group to each of 8 class teams and will notice which team makes the best record for speed and accuracy.

24. Make and solve five concrete problems in multiplication based on your own experience.

DIVISION

Written Work

1. Divide 8528 by 21.

    Steps

$$406\tfrac{2}{21}$$

$$21\overline{)8528}$$
$$\underline{84}$$
$$128$$
$$\underline{126}$$
$$2, \text{ r.}$$

Test. $21 \times 406 = 8526;$
        $8526 + 2 = 8528.$

1. Divide 85 by 21. Write the quotient figure **4** over the figure 5 of the dividend.

2. Multiply 21 by 4.

3. Subtract 84 from 85.

4. Bring down the next figure. Is 21 contained a whole number of times in 12? Write 0 in the quotient.

5. Bring down the next figure and proceed as before. Write 6 in the quotient. The remainder (r.) is 2. The remainder represents $2 \div 21$, or $\tfrac{2}{21}$. Write it as $\tfrac{2}{21}$ in the quotient.

2. Divide $56.48 by 16.

    $3.53
$$16\overline{)\$56.48}$$

Divide as in Ex. 1, placing a decimal point directly above the decimal point in the dividend.

3. Divide 225 by 20.

$$2|0\overline{)22|5}$$
$$11\tfrac{5}{20}$$

Divide both dividend and divisor by 10 as shown in the model. 2 is contained 11 times in 22. The 5 cut off from the dividend is the **remainder.** $5 \div 20 = \tfrac{5}{20}$. The quotient is $11\tfrac{5}{20}$, or $11\tfrac{1}{4}$.

Divide each number by 20; by 50; by 80; by 500.

4. 37,845	**6.** 90,200	**8.** $4098.50	**10.** $3900.50
5. 50,240	**7.** 74,079	**9.** $7900.75	**11.** $9850.25

Divide and test:

12. 6,464,341		*a.* 268
13. 7,846,760	by	*b.* 354
14. 5,864,548		*c.* 676
15. 8,649,343		*d.* 758

Form 4 groups of 4 examples each by dividing each dividend by each divisor:

12 *b.* $6,464,341 \div 354 = ?$

NOTE. The teacher will assign a different group to each of 4 class teams and will notice which team makes the best record.

16. Make and solve five everyday problems in division.

COMMON FRACTIONS

Note. Review pp. 28 to 80. Encourage the children to establish a class standard as suggested on p. 150.

Change to improper fractions:

1. $15\frac{2}{3}$	**4.** $60\frac{5}{12}$	**7.** $95\frac{7}{20}$	**10.** $65\frac{9}{25}$
2. $17\frac{3}{4}$	**5.** $45\frac{3}{20}$	**8.** $48\frac{12}{20}$	**11.** $28\frac{11}{25}$
3. $18\frac{5}{6}$	**6.** $56\frac{5}{16}$	**9.** $78\frac{3}{50}$	**12.** $47\frac{17}{25}$

Change to mixed numbers:

13. $\frac{18}{5}$	**16.** $\frac{29}{3}$	**19.** $\$\frac{77}{5}$	**22.** $\frac{75}{7}$ mi.
14. $\frac{19}{3}$	**17.** $\frac{65}{8}$	**20.** $\frac{89}{16}$ lb.	**23.** $\frac{83}{12}$ ft.
15. $\frac{25}{4}$	**18.** $\frac{75}{9}$	**21.** $\frac{148}{16}$ hr.	**24.** $\frac{69}{8}$ bu.

Change to lowest terms:

25. $\frac{12}{24}$	**28.** $\frac{28}{60}$	**31.** $\frac{84}{108}$	**34.** $\frac{48}{100}$	**37.** $\frac{160}{180}$
26. $\frac{24}{36}$	**29.** $\frac{18}{40}$	**32.** $\frac{120}{144}$	**35.** $\frac{120}{360}$	**38.** $\frac{144}{210}$
27. $\frac{28}{42}$	**30.** $\frac{60}{96}$	**33.** $\frac{132}{192}$	**36.** $\frac{56}{144}$	**39.** $\frac{175}{375}$

Change to similar fractions having the l. c. d.; then add:

40. $\frac{1}{2}, \frac{1}{3}$	**50.** $\frac{1}{3}, \frac{3}{8}, \frac{4}{5}$	**60.** $4\frac{11}{16}, 2\frac{7}{4}, \frac{9}{32}$
41. $\frac{1}{4}, \frac{1}{6}$	**51.** $\frac{3}{4}, \frac{2}{7}, \frac{3}{7}$	**61.** $1\frac{5}{28}, \frac{3}{4}, \frac{4}{7}$
42. $\frac{1}{5}, \frac{1}{4}$	**52.** $\frac{7}{8}, \frac{2}{5}, \frac{3}{10}$	**62.** $3\frac{5}{12}, \frac{7}{12}, 2\frac{9}{24}$
43. $\frac{2}{3}, \frac{3}{4}$	**53.** $\frac{5}{12}, \frac{4}{5}, \frac{2}{3}$	**63.** $\frac{2}{15}, \frac{5}{12}, \frac{3}{4}$
44. $\frac{5}{6}, \frac{3}{8}$	**54.** $\frac{4}{7}, \frac{1}{3}, \frac{7}{9}$	**64.** $5\frac{1}{12}, \frac{3}{4}, 6\frac{2}{3}$
45. $\frac{3}{4}, \frac{7}{9}$	**55.** $\frac{5}{12}, \frac{4}{5}$	**65.** $9\frac{2}{3}, 7\frac{7}{8}, 12\frac{3}{4}$
46. $\frac{7}{9}, \frac{3}{8}$	**56.** $\frac{9}{10}, \frac{7}{8}$	**66.** $8\frac{4}{5}, \frac{6}{7}, 4\frac{5}{8}$
47. $\frac{6}{7}, \frac{4}{5}$	**57.** $\frac{2}{3}, \frac{3}{4}, \frac{1}{2}$	**67.** $6\frac{2}{7}, 2\frac{1}{3}, 5\frac{3}{4}$
48. $\frac{4}{9}, \frac{5}{8}$	**58.** $\frac{2}{3}, \frac{6}{5}, \frac{5}{6}$	**68.** $3\frac{4}{9}, \frac{1}{2}, 15\frac{2}{3}$
49. $\frac{3}{10}, \frac{2}{3}$	**59.** $\frac{6}{7}, \frac{1}{9}, \frac{1}{4}$	**69.** $4\frac{7}{8}, \frac{7}{18}, 20\frac{8}{9}$

Find the value of:

70. $\frac{6}{7} - \frac{4}{5}$

71. $3\frac{1}{3} - 1\frac{1}{2}$

72. $5 - 1\frac{2}{3}$

73. $5\frac{1}{4} - 2\frac{2}{5}$

74. $10\frac{3}{8} - 5\frac{3}{4}$

75. $20\frac{1}{12} - 13\frac{5}{8}$

76. $7\frac{5}{9} - 2\frac{1}{3}$

77. $50\frac{1}{5} - 30\frac{1}{3}$

78. $6\frac{3}{5} - 2\frac{3}{7}$

79. $31\frac{9}{16} - 20\frac{5}{12}$

80. $11\frac{3}{5} - 5\frac{2}{3}$

81. $15 - 9\frac{9}{10}$

82. $65\frac{4}{15} - 63\frac{9}{20}$

83. $44\frac{3}{4} - 12\frac{1}{2}$

84. $36\frac{2}{3} - 11\frac{4}{15}$

85. $27\frac{4}{5} - 19\frac{9}{10}$

86. $81\frac{5}{6} - 14\frac{6}{7}$

87. $12\frac{3}{5} - 2\frac{3}{7}$

Find the value of:

88. $\frac{2}{3} + \frac{3}{4} - \frac{5}{6}$

89. $3\frac{1}{2} + 2\frac{1}{4} - 1\frac{5}{8}$

90. $5\frac{1}{3} + 4\frac{5}{6} - 4\frac{5}{12}$

91. $1\frac{5}{8} + 2\frac{1}{12} - 1\frac{5}{6}$

92. $9\frac{3}{5} - 4\frac{2}{5} + 3\frac{7}{10}$

93. $15 - 3\frac{2}{3} + 4\frac{1}{5}$

94. $40\frac{1}{2} + 60\frac{1}{9} + 30\frac{11}{18}$

95. $19\frac{27}{32} - 11\frac{5}{8} + 1\frac{5}{16}$

96. $7\frac{7}{9} + 4\frac{1}{3} + 11\frac{5}{18}$

97. $3\frac{5}{12} + 9\frac{5}{9} - 7\frac{7}{24}$

Find the products:

98. $16 \times \frac{3}{8}$

99. $24 \times \frac{7}{8}$

100. $27 \times \frac{2}{3}$

101. $45 \times \frac{4}{9}$

102. $18 \times \frac{8}{9}$

103. $12 \times \frac{5}{6}$

104. $13 \times \frac{19}{26}$

105. $14 \times \frac{11}{12}$

106. $25 \times \frac{8}{15}$

107. $15 \times \frac{11}{3}$

108. $10 \times \frac{13}{25}$

109. $21 \times \frac{25}{36}$

110. $36 \times \frac{11}{144}$

111. $18 \times \frac{11}{360}$

112. $27 \times \frac{7}{9}$

113. $15 \times \frac{13}{16}$

114. $9 \times 2\frac{1}{4}$

115. $12 \times 3\frac{2}{3}$

116. $18 \times 5\frac{2}{3}$

117. $22 \times 4\frac{3}{10}$

118. $21 \times 2\frac{5}{14}$

119. $7 \times 8\frac{1}{2}$

120. $10 \times 2\frac{7}{15}$

121. $16 \times 9\frac{5}{13}$

Find the value of:

122. $\frac{2}{3}$ of $\frac{5}{6}$

123. $\frac{3}{5}$ of $\frac{5}{7}$

124. $\frac{3}{4}$ of $\frac{5}{6}$

125. $\frac{2}{3}$ of $\frac{7}{9}$

126. $\frac{5}{6}$ of $\frac{3}{5}$

127. $\frac{7}{8}$ of $\frac{14}{15}$

128. $\frac{9}{10}$ of $\frac{5}{12}$

129. $\frac{8}{11}$ of $\frac{11}{12}$

130. $\frac{15}{16}$ of $\frac{3}{4}$

131. $\frac{5}{16}$ of $\frac{8}{9}$

132. $\frac{15}{32}$ of $\frac{8}{9}$

133. $\frac{3}{10}$ of $\frac{7}{10}$

134. $\frac{7}{8}$ of $\frac{3}{4}$

135. $\frac{9}{10}$ of $\frac{5}{6}$ of $\frac{3}{8}$

136. $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{2}{5}$

Find the value of:

137. $1\frac{1}{2} \times 1\frac{1}{3}$

138. $2\frac{1}{2} \times 3\frac{2}{3}$

139. $2\frac{3}{4} \times 3\frac{5}{6}$

140. $1\frac{3}{8} \times 2\frac{5}{9}$

141. $6\frac{1}{3} \times 2\frac{1}{4}$

142. $16\frac{2}{3} \times 5\frac{1}{7}$

143. $20\frac{1}{4} \times 5\frac{7}{9}$

144. $12\frac{4}{5} \times 1\frac{7}{8}$

145. $39\frac{3}{5} \times 66\frac{1}{2}$

Find the value of:

146. $\frac{4}{5} \div 2$

147. $\frac{8}{9} \div 4$

148. $\frac{12}{13} \div 8$

149. $\frac{15}{16} \div 5$

150. $\frac{18}{25} \div 6$

151. $\frac{16}{17} \div 8$

152. $\frac{6}{7} \div 5$

153. $\frac{24}{25} \div 8$

154. $\frac{14}{25} \div 7$

155. $\frac{15}{16} \div 10$

156. $18 \div \frac{3}{4}$

157. $21 \div \frac{7}{8}$

158. $24 \div \frac{2}{9}$

159. $15 \div \frac{5}{6}$

160. $27 \div \frac{9}{10}$

161. $25 \div \frac{5}{8}$

162. $33 \div \frac{3}{7}$

163. $35 \div \frac{7}{12}$

164. $48 \div \frac{6}{7}$

165. $40 \div \frac{10}{11}$

166. $11 \div \frac{99}{100}$

167. $9 \div \frac{27}{100}$

168. $9 \div \frac{81}{100}$

169. $10 \div \frac{20}{21}$

170. $7 \div \frac{63}{100}$

171. $853\frac{1}{8} \div 5$

172. $267\frac{3}{4} \div 9$

173. $687\frac{7}{9} \div 10$

174. $206\frac{2}{5} \div 6$

175. $790\frac{3}{10} \div 7$

Find the quotients:

176. $\frac{7}{8} \div \frac{2}{3}$

177. $\frac{7}{15} \div \frac{7}{15}$

178. $\frac{5}{6} \div \frac{7}{8}$

179. $\frac{7}{12} \div \frac{5}{12}$

180. $\frac{3}{4} \div \frac{7}{8}$

181. $\frac{5}{9} \div \frac{2}{10}$

182. $\frac{8}{7} \div \frac{5}{14}$

183. $\frac{4}{15} \div \frac{3}{4}$

184. $1\frac{2}{3} \div \frac{3}{4}$

185. $5\frac{4}{5} \div 2\frac{5}{6}$

186. $3\frac{3}{4} \div 4$

187. $5\frac{7}{8} \div 10$

188. $10 \div \frac{2}{5}$

189. $1\frac{1}{4} \div \frac{1}{4}$

190. $12 \div \frac{6}{7}$

191. $13 \div \frac{5}{7}$

192. $25 \div \frac{7}{8}$

193. $121 \div \frac{11}{12}$

194. $256 \div \frac{16}{21}$

195. $42 \div \frac{5}{9}$

196. $55 \div \frac{6}{11}$

197. $\frac{11}{12} \div \frac{5}{9}$

198. $\frac{12}{13} \div \frac{6}{11}$

199. $\frac{7}{15} \div \frac{1}{5}$

200. $2\frac{1}{2} \div 2\frac{1}{3}$

201. $12\frac{1}{2} \div 16\frac{2}{3}$

202. $8\frac{2}{3} \div 4\frac{2}{3}$

203. $5\frac{1}{2} \div 4\frac{1}{4}$

204. $7\frac{3}{8} \div 6\frac{1}{2}$

205. $8\frac{4}{5} \div 4\frac{1}{4}$

206. $8\frac{3}{4} \div 3\frac{1}{2}$

207. $5\frac{5}{6} \div 4\frac{2}{3}$

208. $37\frac{1}{2} \div 12\frac{1}{2}$

209. $8\frac{2}{5} \div 2\frac{5}{8}$

210. $3\frac{1}{3} \div 2\frac{1}{3}$

211. $5\frac{1}{10} \div 1\frac{7}{10}$

DECIMALS

Any unit may be divided into 10ths, 100ths, 1000ths, etc.

Any number of tenths, hundredths, thousandths, etc., **of a** unit is called a **decimal fraction.** When expressed with a decimal point, without a written denominator, it is usually called a **decimal.**

Thus, $\frac{5}{10}$ and .5, $\frac{5}{100}$ and .05, $\frac{5}{1000}$ and .005, are *decimal fractions*, but the term *decimal* is usually restricted to the forms .5, .05, .005, .0005, etc.

Express decimally:

1. $\frac{5}{10}$	$\frac{5}{100}$	$\frac{4}{1000}$	$\frac{1}{10000}$
2. $\frac{8}{10}$	$\frac{39}{100}$	$\frac{24}{1000}$	$\frac{125}{10000}$
3. $\frac{9}{10}$	$\frac{25}{100}$	$\frac{175}{1000}$	$\frac{1256}{10000}$

4. In 5.55, the figure in tenths' place equals how **many** times the figure in hundredths' place? The figure in ones' place equals how many times the figure in tenths' place?

A decimal point is used to separate units from parts of units. It is always placed at the right of ones' place and before tenths' place.

5. What is the *first* place to the right of a decimal point called? the *second* place? the *third* place?

6. What is the largest decimal division of any unit? the *second* largest? the *third* largest?

In any decimal or whole number, **10** *units of any place* $= 1$ *unit of the next place to the left.*

Show that United States money is a decimal system.

NOTATION AND NUMERATION OF DECIMALS

1. Express decimally $\frac{5}{10}$, $\frac{75}{100}$, $\frac{6}{1000}$, $\frac{54}{1000}$, $\frac{6}{100}$, $\frac{72}{1000}$.

The names of the decimal places most frequently used are given in the following table:

Thousands	Hundreds	Tens	Ones	Decimal point	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
9	0	0	5	.	0	9	7	4	8	9

The number is read "nine thousand five and ninety-seven thousand four hundred eighty-nine millionths." Notice that the word *and* is read only between the whole number and the decimal.

2. How many places to the right of the decimal point are *tenths* written? *hundredths? thousandths? ten-thousandths? hundred-thousandths? millionths?*

Read:

3. .25	**6.** .375	**9.** .4045	**12.** .678705
4. .05	**7.** .101	**10.** .0002	**13.** .0065
5. .005	**8.** .0045	**11.** .60745	**14.** .60005

15. Since $.5 = .50 = .500$, does canceling zeros from the right of a decimal change the value of the decimal?

Observe that canceling zeros from the right of a decimal really means canceling zeros from the numerator and the denominator. Thus, $.50 = \frac{50}{100} = .5\cancel{0} = \frac{5\cancel{0}}{10\cancel{0}}$.

Read first as given, then as if the zeros at the right of the decimal were canceled:

16. .040	**18.** .7500	**20.** .0057
17. .0050	**19.** .0090	**21.** .0900

Read:

22. .3429	**24.** .50644	**26.** .0875
23. .0897	**25.** .873702	**27.** .90002

A whole number and a decimal is called a **mixed decimal;** as, 50.625. This is read " 50 *and* 625 thousandths."

Read:

28. 45.075	**31.** 72.003745	**34.** 50.087
29. 50.3007	**32.** 1001.1001	**35.** 6.0089
30. 290.25387	**33.** 794.3085	**36.** 2.00489

In writing a decimal, one figure at the right of the decimal point expresses tenths, two figures express hundredths, three express thousandths, etc. Use as many zeros as are necessary to give hundredths two places, thousandths three places, etc.

Thus, in writing 415 ten thousandths, use one zero, to give four places 0415.

Write:

37. 675 ten-thousandths.

38. 16 and 75 millionths.

39. 400 and 45 thousandths.

40. 6006 and 66 ten-thousandths.

41. Seven hundred and forty-six ten-thousandths.

42. 900 and 84 millionths.

43. 8 and 17 ten-thousandths.

44. 896 and 301 hundred-thousandths.

45. One thousand and one thousandth.

46. 97 and 3 ten-thousandths.

47. 9864 millionths.

48. One million and one tenth.

49. 1830 and 11684 hundred-thousandths.

50. 429 thousand and 46 ten-thousandths

ADDITION AND SUBTRACTION OF DECIMALS

In adding or subtracting decimals, tenths must be placed under tenths, hundredths under hundredths, etc.

Written Work

1. Add .9084 and .004.

```
.9084
.004
.9124
```

2. From 15 take 6.887. **15** may be written 15.000.

Annexing zeros to a decimal does not change its value. Annex as many as necessary.

```
15.000
 6.387
 8.613
```

Add:

3. .85	**4.** 62.8	**5.** 9.556	**6.** 97.
9.06	3.09	0.038	6.4
82.073	99.08	26.908	81.8

Subtract and test:

7. 30.276	**8.** 8.0089	**9.** 318.76	**10.** 48.9
29.008	7.3846	7.96	22.6

Add:

11. 4.56	**12.** 8.057	**13.** 12.31	**14.** 5.621
3.7	.001	.65	.008
5.06	12.3	.001	4.02
8.023	15.024	10.1	9.148
9.04	18.014	25.004	6.327

Find differences:

15. .96	**16.** .4217	**17.** 5.206	**18.** 15.
.2827	.375	4.7869	4.008

19. 97.	**20.** $55.68	**21.** 225.5	**22.** 849.
28.278	32.09	97.439	678.625

First add ; then subtract:

23. 621.4	**24.** 832.3	**25.** 57.05	**26.** 9.0253
305.5	504.9	36.54	8.0699

Add and test :

27. .075	**28.** 6.875	**29.** .901	**30.** 10.101
6.375	.057	.057	9.704
.598	2.079	.864	12.006
.803	.868	9.805	.011
9.603	8.789	7.504	.023

31. Add 1.45, 3.06, 6.605, .09.

32. Add 4.24, 8.2, 6.006, 19.098.

33. Add 11.01, 3.7, 10.01, 2.005.

34. Add .7, .4285, 18.054, 8.0108.

35. Add .002, 22.5607, 1.114, 18.

36. Add 12.6, 25.78, 9.009, .00101, 2.02, .0245.

37. Add .0402, 48.0148, .07089, .1607, 17.0017.

38. Add 89.4004, 75.8002, 761.0612, 1245.0005.

Find differences :

39. $5.32 - 3.245$

40. $10.004 - 6.205$

41. $125.04 - 86.008$

42. $12 - 3.001$

43. $350.25 - 180.175$

44. $221.201 - 175.1254$

45. $434.5196 - 178.3021$

46. $90.909 - 9.9009$

47. $18 - 11.006$

48. $245.045 - 138.1256$

49. $100.101 - 95.095$

50. $300.333 - 195.033$

51. $20.93875 - 15.55$

52. $100 - .9999$

53. From $.06 + .0875 + 49.03$ take $.025 + 2.0025 + 43.701.$

54. From the sum of .2305 and .9105 take 1.

55. From the sum of 27.045 and .7001 take their difference.

56. From the sum of 43.005 and .0256 take their difference.

57. What is the weight in tons of 4 loads of coal, which weigh 1.5 T., 1.25 T., 1.75 T., and 1.9 T. ?

58. How many feet are there in three distances measuring 2675.25 ft., 6785.875 ft., and 5674.5 ft. ?

59. Mary's temperature on Monday is 99.1 degrees, and on Wednesday 102.7 degrees. Find the increase in temperature each day over normal.

NOTE. The normal temperature of the body of a person in good health is 98.6 degrees Fahrenheit.

60. The weather bureau in Birmingham, Ala., for three days shows the following rainfall : Monday, .97 in.; Tuesday, 1.37 in.; Wednesday, .37 in. Find the total rainfall for the three days.

61. The rainfall in Chicago for five days is as follows : Monday, .25 in. ; Tuesday, 1.3 in.; Wednesday, nothing; Thursday, 1.07 in.; Friday, 1.09 in. Find the rainfall for the five days.

62. In the air mail service between New York and Washington an airplane covers 67.25 mi. the first hour, 68.15 mi. the second hour, 69.25 mi. the third hour, and 5.35 mi. in the last stretch. Find the total distance covered.

63. A man owns a triangular piece of land. The perimeter of the triangle is 371.79 ft. Two of the sides are 97.9 ft. and 121.39 ft. Find the other side.

64. A dairyman tests the milk of five cows. Spot shows 4.3 lb. of *butter fat* to every 100 lb. of milk; White Star shows 3.93 lb.; Glory shows 4.75 lb.; Beauty shows 4.2 lb.; and Princess shows 3.99 lb. Find the total number of pounds of butter fat in 500 lb. of milk, taking 100 lb. from each cow.

65. Make and solve a problem in addition of decimals; in subtraction of decimals.

MULTIPLICATION OF DECIMALS

Oral Work

1. How many are $5 \times .3$? $5 \times .03$? $5 \times .003$?

2. How many are $.5 \times 4$? 2.5×5?

3. When a decimal is multiplied by an integer or an integer by a decimal, what do you observe about the number of decimal places in the product?

Multiply:

4. 3.5×2	**6.** 4×5.5	**8.** 2.4×4	**10.** 6×1.25
5. 2.3×3	**7.** 3×2.1	**9.** 3.75×2	**11.** 9×1.04

How to multiply by 10, 100, 1000, etc., by moving the decimal point.

1. Multiply 5.25 by 10; by 100; by 1000.

$10 \times 5.25 = 52.50$
$100 \times 5.25 = 525.00$
$1000 \times 5.25 = 5250.00$

How is the value of a number affected by moving the decimal point *one place* to the right? *two places*? *three places*?

How, then, may a decimal be multiplied by 10? by 100? by 1000?

Multiply first by 10; then by 100; then by 1000:

2. 42.07	**5.** 16.94	**8.** 222.461	**11.** .005
3. 113.55	**6.** 849.02	**9.** 333.059	**12.** 4.009
4. 264.03	**7.** 500.09	**10.** 29.004	**13.** 13.655

How to multiply a decimal by a decimal.

1. Multiply .01 by .1. $\frac{1}{10} \times \frac{1}{100} = \frac{1}{1000}$, or .001.

2. Multiply 1.5 by .5. $1.5 = \frac{15}{10}$; $\frac{5}{10} \times \frac{15}{10} = \frac{75}{100}$, or .75.

3. When a decimal is multiplied by a decimal, what do you observe about the number of decimal places in the product?

Written Work

1. Multiply .75 by .3.

```
.75
 .3
.225
```

Since there are two decimal places in the multiplicand and one in the multiplier, point off three decimal places in the product, making the product .225.

Test. $.75 = \frac{75}{100}$ and $.3 = \frac{3}{10}$. $\frac{75}{100} \times \frac{3}{10} = \frac{225}{1000}$, or **.225**.

2. Multiply .25 by .13.

```
 .25
 .13
 75
 25
.0325
```

a. What is the sum of the decimal places in the multiplier and the multiplicand?

b. The product, then, must contain how many places?

When the product has not enough decimal places, prefix zeros to supply the deficiency.

Test. $.25 = \frac{25}{100}$; $.13 = \frac{13}{100}$; $\frac{25}{100} \times \frac{13}{100} = \frac{325}{10000} = .0325$.

Multiply as in integers, pointing off as many decimal places in the product as there are decimal places in both factors.

How many decimal places must be pointed off in each of the following products? (Do not find the products.)

3. $.8 \times .27$	**8.** 3.21×4.5	**13.** $1.45 \times .48$
4. $.5 \times .45$	**9.** $7.24 \times .08$	**14.** $11.4 \times .15$
5. $.15 \times .256$	**10.** $.011 \times .42$	**15.** $.025 \times .124$
6. 6.5×1.5	**11.** $.57 \times .15$	**16.** 22.5×4.04
7. 5.7×9.4	**12.** $2.03 \times .4$	**17.** $.75 \times .624$

Find the products:

18. $.4 \times 5.6$	**25.** $.7 \times 6.5$	**32.** $.145 \times .625$
19. $.5 \times 7.5$	**26.** $.8 \times 5.7$	**33.** $.046 \times .752$
20. $.3 \times 8.4$	**27.** $.12 \times .25$	**34.** $.125 \times .246$
21. $.7 \times 9.3$	**28.** $.22 \times .14$	**35.** $.414 \times .601$
22. $.8 \times 6.8$	**29.** $.25 \times .25$	**36.** $.851 \times .004$
23. $.6 \times 5.8$	**30.** $.32 \times .43$	**37.** $.654 \times 1.08$
24. $.5 \times 7.2$	**31.** $.41 \times .55$	**38.** $.506 \times 24.6$

Find the products:

39. $.15 \times 3.04$	**66.** 36.8×44	**93.** 6.95×3.03
40. $.8 \times 10.34$	**67.** 48.25×72	**94.** $426 \times .083$
41. $.18 \times .004$	**68.** 625.6×9.5	**95.** $727 \times .62$
42. $.122 \times .024$	**69.** 49.10×17.4	**96.** $647 \times .5$
43. $.215 \times .015$	**70.** $.0914 \times .015$	**97.** $59.4 \times .09$
44. $.83 \times .007$	**71.** $2.184 \times .002$	**98.** 8.88×4.7
45. $.212 \times 2.042$	**72.** 5.683×7	**99.** $9.79 \times .61$
46. $.432 \times .078$	**73.** $.4234 \times 448$	**100.** $.707 \times 9.1$
47. $.101 \times .012$	**74.** $.96 \times 1.02$	**101.** 8.6×8.4
48. $.14 \times 89.76$	**75.** $.407 \times 4.05$	**102.** $3.5 \times .007$
49. $.112 \times .092$	**76.** $.04 \times .078$	**103.** 15.02×5.001
50. $.363 \times .003$	**77.** $.64 \times .016$	**104.** $.023 \times .021$
51. $.90 \times 5.78$	**78.** $.012 \times .024$	**105.** $.007 \times 4.8$
52. $.36 \times 6.48$	**79.** $.625 \times .001$	**106.** 1.78×1.024
53. $.325 \times .125$	**80.** $.872 \times .096$	**107.** 8.132×2.4
54. $.043 \times .057$	**81.** $.004 \times .004$	**108.** 10.001×7.07
55. $.016 \times .235$	**82.** $.505 \times .55$	**109.** 52.5×7.07
56. $.534 \times .223$	**83.** $.216 \times .027$	**110.** 7.135×8.56
57. $.261 \times .175$	**84.** $.244 \times .014$	**111.** 9.901×1.99
58. $.022 \times .022$	**85.** $.009 \times .099$	**112.** 6.375×44.8
59. $.632 \times .085$	**86.** $.101 \times .101$	**113.** 2.063×14.204
60. $.99 \times 4.17$	**87.** $.756 \times .124$	**114.** 101.1×11.01
61. $.402 \times 4.02$	**88.** $.456 \times .032$	**115.** 44.006×6.044
62. $.472 \times .054$	**89.** $.038 \times .097$	**116.** 5.117×1.88
63. $.122 \times .562$	**90.** 2.5×1.75	**117.** 16.004×16.64
64. $.144 \times .032$	**91.** 14.4×1.32	**118.** 2.406×15.108
65. $2.005 \times .021$	**92.** 1.85×2.97	**119.** 1.041×9.009

Written Work

1. Turnips are .9 water. Find the amount of water in 50.5 lb. of turnips.

2. A lot is 32.7 ft. wide and 75.9 ft. long. How many square feet are there in the lot?

3. A lot in Dallas, Tex., is 22.6 ft. wide and 79.84 ft. long. It is sold at $ 3.50 a square foot. How much is the lot sold for?

4. A man paves a street 908.6 ft. long and 29.30 ft. wide. How many square feet are there in the street paved?

5. A cubic foot of water weighs 62.5 lb. A cubic foot of ice weighs .92 as much. Find the weight of a cubic foot of ice.

6. A cubic foot of cork weighs .24 as much as a cubic foot of water. Find the weight of the cork.

7. A block of ice is 2 ft. long, 1.5 ft. wide, and 1 ft. thick. Find its weight.

8. A piece of sandstone is 1 ft. square at the end, and 4 ft. long. How many cubic feet are there in it? Sandstone is 2.9 times as heavy as water. Find the weight of the sandstone.

9. Milk is 1.03 times as heavy as water. If a gallon of water weighs 8.5 lb., how much does a gallon of milk weigh?

10. Find the cost of 1.365 acres of land at $ 875.50 an acre.

11. The boys at school form a circular race track 79.6 ft. across. Find the length of the race track, the circumference being 3.1416 times the distance across.

12. Make a problem in multiplication of decimals, based on your experience.

DIVISION OF DECIMALS

How to divide a decimal or a mixed decimal by an integer.

Oral Work

1. Find $\frac{1}{5}$ of 45 hundredths ; of 60 hundredths.

2. Find $\frac{1}{4}$ of .24 ; of .36 ; of .44.

3. Find $\frac{1}{8}$ of 8 and 48 hundredths.

4. Find $\frac{1}{8}$ of 8.72 ; $\frac{1}{6}$ of 18.36.

$$\frac{8)8.72}{1.09} \quad \text{or} \quad \frac{1.09}{8)8.72} \qquad \frac{6)18.36}{3.06} \quad \text{or} \quad \frac{3.06}{6)18.36}$$

A decimal or a mixed decimal is divided by an integer by placing a decimal point above or below the decimal point in the dividend, before beginning to divide, and dividing as in the division of integers.

Find the quotients :

5. $48.66 \div 6$	**10.** $5.1250 \div 25$	**15.** $100.25 \div 25$
6. $545.5 \div 5$	**11.** $.93093 \div 31$	**16.** $64.064 \div 32$
7. $60.84 \div 12$	**12.** $24.624 \div 54$	**17.** $3510.5 \div 35$
8. $19.5 \div 15$	**13.** $4.50 \div 30$	**18.** $64.064 \div 64$
9. $56.56 \div 14$	**14.** $806.4 \div 16$	**19.** $48.048 \div 48$

How to divide a decimal by a decimal.

Oral Work

1. In what short way may a decimal be multiplied by 10 ? by 100 ? by 1000 ?

2. In .5, .25, .025, move the decimal point one place to the right and read the result ; two places to the right ; three places to the right

Explain why :

3. $.2\overline{).24} = 2\overline{)2.4}$; $\quad .04\overline{).0164} = 4\overline{)1.64}$; $\quad 1.6\overline{)25.6} = 16\overline{)256}$

4. $.6\overline{)18} = 6\overline{)180}$; $\quad .12\overline{).144} = 12\overline{)14.4}$; $\quad .08\overline{).48} = 8\overline{)48}$

5. $.09\overline{)8.1} = 9\overline{)810}$; $\quad .25\overline{)2.25} = 25\overline{)225}$; $\quad .05\overline{)5} = 5\overline{)500}$

Multiplying both dividend and divisor by 10, *by* 100, *or by* 1000, *etc., does not change the quotient.*

Tell the number of places the decimal point must be moved to the right in both dividend and divisor in each of the following problems in order to make the divisor an integer; then give the quotients :

	a	b	c	d	e
6.	$.5\overline{).25}$	$.2\overline{)2.6}$	$4\overline{)4.4}$	$.6\overline{)66}$	$8\overline{)8.08}$
7.	$.03\overline{).15}$	$.12\overline{).96}$	$.07\overline{).21}$	$.09\overline{).81}$	$.05\overline{).05}$

Written Work

1. Divide 5.68 by .8.

$$.8\overline{)5.68} = (a) \quad 8\overline{)\begin{array}{c} 7.1 \\ 56.8 \end{array}}$$

$$\text{Or, } (b) \quad .8\overline{)5.6_\wedge 8} \quad \begin{array}{c} 7.1 \end{array}$$

In (a) both dividend and divisor are multiplied by 10 to make the divisor a whole number. This is done by moving the decimal point in the divisor and the dividend one place to the right.

In (b) the example is written in its original form and the changed position of the decimal point in the dividend is indicated by a caret, placed as many places to the right of the decimal point as there are decimal places in the divisor. As there is one decimal place in the divisor, place the caret one place to the right of the decimal point in the dividend. Then divide as in integers, placing the decimal point in the quotient immediately after all the numbers to the left of the caret have been used in the process of division.

NOTE. The method illustrated in (b) retains the identity of the problem and saves the time consumed in restating it.

2. Divide 96.8 by .004.

```
        24200
.004 )96.800
```

As there are three decimal places in the divisor, place the caret three places to the right of the point in the dividend. Two zeros must be annexed to give three decimal places. Place the decimal point in the quotient immediately after all the numbers to the left of the caret have been used. The answer is a whole number.

3. Divide 1.2864 by .032.

```
          40.2
.032 )1.286,4
       1 28
         64
         64
```

As there are three decimal places in the divisor, place the caret three places to the right of the point in the dividend. Place the decimal point in the quotient immediately after all the numbers to the left of the caret have been used in the division.

Mark off by a caret the same number of decimal places from the right of the decimal point in the dividend as there are decimal places in the divisor. Divide as in integers, placing the decimal point in the quotient immediately after all the numbers to the left of the caret have been used in the process of division.

Divide and test :

4. 6 by .3	**12.** 70 by .0056	**20.** 1 by .001
5. 9 by .06	**13.** 154 by .28	**21.** 10 by .001
6. 21 by .7	**14.** 78 by .052	**22.** 17 by .68
7. 10 by .01	**15.** 190 by .076	**23.** 112 by .032
8. 25 by .125	**16.** 115 by 6.25	**24.** 324 by .27
9. 80 by .125	**17.** 18 by .375	**25.** 1904 by .119
10. 36 by .75	**18.** 4 by .016	**26.** 114 by .76
11. 128 by .032	**19.** 48 by .1875	**27.** 896 by .256

Find the quotients and test the results :

28. .04 ÷ .002	**31.** .004 ÷ .004	**34.** .728 ÷ .13
29. .8 ÷ .25	**32.** .1952 ÷ 16	**35.** .3136 ÷ .224
30. .125 ÷ .5	**33.** .00624 ÷ .8	**36.** .4725 ÷ .2

37. .112 ÷ 7

38. .036 ÷ 4

39. .0001 ÷ .01

40. .0187 ÷ .011

41. .555 ÷ .37

42. .655 ÷ .131

43. .75 ÷ .125

44. .3625 ÷ .125

45. 1.44 ÷ .036

46. .9 ÷ .015

47. .1 ÷ 1.25

48. 9 ÷ 2.25

49. .3 ÷ .03

50. 8.10 ÷ .54

51. .126 ÷ .07

52. 4.199 ÷ 1.9

53. 43.46 ÷ 21.2

54. 432 ÷ .36

55. .432 ÷ 36

56. 15.68 ÷ .028

57. .20956 ÷ .169

58. .0247 ÷ .019

59. .8799 ÷ .7

60. .08799 ÷ .007

61. .15158 ÷ .286

62. .837 ÷ .135

63. 1.5 ÷ .005

64. 10.8 ÷ .12

65. 1.32 ÷ 11

66. 31.75 ÷ .025

67. .5475 ÷ 1.5

68. 1.728 ÷ 17.28

69. 1.111 ÷ 11.11

70. 100.5 ÷ 1.005

71. 9.375 ÷ .75

72. .3105 ÷ .15

73. .5 ÷ .125

74. 13.410 ÷ .018

75. 27.839 ÷ 2.87

76. 232.5 ÷ .9375

77. .00261 ÷ .145

78. .003410 ÷ .62

79. .4375 ÷ .125

80. .17225 ÷ .325

81. .7665 ÷ .365

82. .2944 ÷ .512

83. .421875 ÷ .125

84. 8.686 ÷ 86.86

85. .01 ÷ .001

86. 100 ÷ 1000

87. 7.25 ÷ .025

88. 1.225 ÷ 3.5

89. 139.956 ÷ 3.21

90. 86.784 ÷ 226

91. 46.695 ÷ 1.65

92. .0011 ÷ 100

93. 1100 ÷ .011

94. .025 ÷ .00625

95. .0009 ÷ 4.5

96. 2.10 ÷ .01

97. .137 ÷ 200

98. .02116 ÷ 92

99. 25.125 ÷ 1.005

100. A $50 Liberty bond paid for 2 miles of bandages. What was the price per yard, to mills? (1760 yd. = 1 mi.)

101. If the price of gas was $1.00 a thousand cubic feet, how much was the average gas bill per month, when 85,620 cubic feet were consumed in 6 months?

102. How many bushels of apples, at $1.95 a bushel, could be bought for $81.90?

103. A farm of 343.75 acres was sold in plots of **1.25** acres each, the price for each plot being $75.50. How much was received for the farm?

104. An engineer in building a bridge employed 40 men for $7\frac{1}{2}$ weeks of 6 days each, paying them $9450. If each man earned the same amount, find the daily wages of each. Find also the daily wages of 30 additional men to whom the engineer paid $3881.25 for $4\frac{1}{2}$ weeks of 5 days each.

105. A merchant bought 140 boys' suits of the same kind for $945. What was the price per suit? He sold $\frac{3}{4}$ of them at $9.50 a suit and the remainder at $8.50 a suit. How much did he gain?

106. If the rainfall in a city averages .1 of an inch a day, in how many days does the rainfall amount to 3 inches?

107. How many layers of gold leaf will be required to form a tablet 5 inches thick, if each layer is .001 of an inch thick?

108. A merchant bought 975 pounds of sugar for $78. What price per pound did he pay?

109. A boy bought apples at the rate of 4 for 10 cents, and sold them at the rate of 3 for 10 cents. If he made $3 in a week of 6 days, what were his daily average sales?

110. The total daily wages of 3000 employees in a steel mill were $13,500. What was the average wage of each employee?

111. In a certain school the salary of the teacher for the term was $900. The books and supplies cost $120.60; fuel, $100; repairs and other expenses, $115.30. There were 35 pupils in the school. Find the average cost per pupil for the term.

112. How long does it take a train that averages 30.5 mi. an hour to run a distance of 189.1 mi.?

COMPARISON OF COMMON FRACTIONS AND DECIMALS

How to change decimals to common fractions.

Oral Work

Change to common fractions in lowest terms:

1. .25	**3.** .04	**5.** .5	**7.** .45
2. .50	**4.** .02	**6.** .8	**8.** .75

9. Give the steps in changing a decimal to its fractional equivalent.

Sometimes a decimal and a fraction are united; as, .16$\frac{2}{3}$, which is read "16$\frac{2}{3}$ hundredths."

Written Work

1. Change .87$\frac{1}{2}$ to a common fraction in its lowest terms.

.87$\frac{1}{2}$ = .875 = $\frac{875}{1000}$, or $\frac{7}{8}$ Express the denominator of the decimal and reduce the resulting fraction to its lowest terms

2. Change .66$\frac{2}{3}$ to a common fraction.

.66$\frac{2}{3}$ = $\frac{200}{3}$ ÷ 100 = $\frac{200}{300}$, or $\frac{2}{3}$ Since 66$\frac{2}{3}$ = $\frac{200}{3}$, .66$\frac{2}{3}$ = $\frac{200}{3}$ ÷ 100, or $\frac{200}{300}$. This reduced to its lowest terms equals $\frac{2}{3}$.

3. Change .075 to a fraction in its lowest terms.

.075 = $\frac{75}{1000}$, or $\frac{3}{40}$ Express .075 with its denominator 1000 and reduce the fraction to its lowest terms, $\frac{3}{40}$.

Change the following decimals to fractions in their lowest terms:

4. .35	**9.** .16$\frac{2}{3}$	**14.** .83$\frac{1}{3}$	**19.** .03$\frac{1}{3}$
5. .24	**10.** .41$\frac{2}{3}$	**15.** .33$\frac{1}{3}$	**20.** .12$\frac{1}{2}$
6. .36	**11.** .62$\frac{1}{2}$	**16.** .06$\frac{1}{4}$	**21.** .14$\frac{2}{7}$
7. .125	**12.** .37$\frac{1}{2}$	**17.** .04$\frac{1}{6}$	**22.** .58$\frac{1}{3}$
8. .375	**13.** .31$\frac{1}{4}$	**18.** .08$\frac{1}{3}$	**23.** .88$\frac{1}{2}$

How to change common fractions to decimals.

Oral and Written Work

1. Change $\frac{4}{5}$ to a decimal.

$\frac{4}{5} = 4 \div 5$ $\dfrac{.8}{5)\overline{4.0}}$ Since $\frac{4}{5} = 4 \div 5$, annex a decimal zero and divide by 5.

2. Change $\frac{3}{7}$ to a decimal.

$\frac{3}{7} = 3 \div 7$ (a) $\dfrac{.428\frac{4}{7}}{7)\overline{3.000}}$

Or, (b) $\dfrac{.428^+}{7)\overline{3.000}}$

Since the division does not terminate, the remainder may be indicated as a *fraction*, as in (a), or the sign $+$ may be used to indicate a remainder, as in (b).

Change to decimals:

3. $\frac{1}{4}$	**6.** $\frac{5}{8}$	**9.** $\frac{3}{5}$	**12.** $\frac{1}{25}$	**15.** $\frac{1}{16}$
4. $\frac{3}{4}$	**7.** $\frac{7}{8}$	**10.** $\frac{1}{20}$	**13.** $\frac{3}{25}$	**16.** $\frac{3}{16}$
5. $\frac{1}{8}$	**8.** $\frac{1}{5}$	**11.** $\frac{3}{20}$	**14.** $\frac{7}{25}$	**17.** $\frac{1}{32}$

Change to decimals of not more than three places:

18. $\frac{1}{3}$	**20.** $\frac{1}{6}$	**22.** $\frac{1}{7}$	**24.** $\frac{1}{9}$	**26.** $\frac{4}{9}$
19. $\frac{2}{3}$	**21.** $\frac{5}{6}$	**23.** $\frac{5}{7}$	**25.** $\frac{2}{9}$	**27.** $\frac{5}{9}$

Change to decimals of not more than four places:

28. $\frac{3}{7}$	**30.** $\frac{7}{11}$	**32.** $\frac{1}{9}$	**34.** $\frac{5}{18}$	**36.** $\frac{1}{60}$
29. $\frac{7}{9}$	**31.** $\frac{5}{14}$	**33.** $\frac{1}{7}$	**35.** $\frac{7}{18}$	**37.** $\frac{2}{7}$

Learn the following:

$\frac{1}{2} = .50$	$\frac{1}{5} = .20$	$\frac{5}{6} = .83\frac{1}{3}$	$\frac{1}{12} = .08\frac{1}{3}$
$\frac{1}{3} = .33\frac{1}{3}$	$\frac{2}{5} = .40$	$\frac{1}{8} = .12\frac{1}{2}$	$\frac{5}{12} = .41\frac{2}{3}$
$\frac{2}{3} = .66\frac{2}{3}$	$\frac{3}{5} = .60$	$\frac{3}{8} = .37\frac{1}{2}$	$\frac{1}{16} = .06\frac{1}{4}$
$\frac{1}{4} = .25$	$\frac{4}{5} = .80$	$\frac{5}{8} = .62\frac{1}{2}$	$\frac{1}{20} = .05$
$\frac{3}{4} = .75$	$\frac{1}{6} = .16\frac{2}{3}$	$\frac{7}{8} = .87\frac{1}{2}$	$\frac{1}{25} = .04$

PERCENTAGE

Another name for hundredths.

1. Frank had $50 and spent $\frac{3}{100}$, or .03, of it. How much money did he spend?

2. Edith misspelled 8 words in a spelling match of 100 words. How many hundredths of the words did she misspell?

3. A reduction of $.10 on $1.00 is a reduction of how many hundredths?

As the number 100 is very convenient in reckoning fractional parts, *hundredths* are used more commonly in business than any other decimal fractions.

Another name for *hundredths* is **per cent.** *Per cent* means *per hundred.* As per cents are so important in business, we make a special study of them, which we call **percentage.**

Remember, however, that *per cents are merely decimal fractions with denominators of* 100.

In common fractions we compute by *halves, thirds, fourths, sixths,* etc.; in decimal fractions we compute by *tenths, hundredths, thousandths,* etc.; but in percentage we compute by *hundredths* only.

The sign for *per cent* is %.

Hundredths may be written in several different ways; as, $\frac{8}{100}$, .08, 8 per cent, 8 %; $\frac{25}{100}$, .25, 25 per cent, 25 %.

Percentage is merely an application of decimal fractions.

Simply express per cents as decimals and then proceed as with decimal fractions.

Oral and Written Work

1. Write the following numbers as per cents:

.02　.05　.03　.15　.20　.25　.40　.06　.75　.87　**.56**

2. Write the following as decimals:

5%　20%　7%　15%　25%　16%　18%　24%　50%　75%

3. Write as decimals and as per cents:

$\frac{1}{2}$　$\frac{3}{4}$　$\frac{1}{20}$　$\frac{1}{25}$　$\frac{1}{10}$　$\frac{2}{5}$　$\frac{1}{5}$　$\frac{9}{10}$　$\frac{3}{5}$　$\frac{9}{20}$　$\frac{7}{25}$

4. $5\% = \frac{?}{20}$; $10\% = \frac{?}{10}$.

5. 25% of $100 may be found in two ways: (a) $25\% = \frac{1}{4}$; $\frac{1}{4}$ of $100 = $25. (b) $25\% = .25$; $.25 \times \$100 = \$25$.

Learn the following:

$50\% = \frac{1}{2}$	$10\% = \frac{1}{10}$	$75\% = \frac{3}{4}$
$25\% = \frac{1}{4}$	$5\% = \frac{1}{20}$	$40\% = \frac{2}{5}$
$20\% = \frac{1}{5}$	$60\% = \frac{3}{5}$	$80\% = \frac{4}{5}$

Give the results rapidly:

6. 20% of $50	**13.** 10% of 30	**20.** 10% of $80
7. 25% of $60	**14.** 50% of 60	**21.** 1% of $200
8. 10% of $40	**15.** 75% of 100	**22.** 3% of $30
9. 50% of $80	**16.** 40% of 20	**23.** 5% of 60 qt.
10. 40% of $75	**17.** 5% of 30	**24.** 20% of 20 pk.
11. 5% of $40	**18.** 15% of 100	**25.** 50% of 80 pt.
12. 6% of $6	**19.** 10% of 70	**26.** 2% of 100 bu.

Written Work

1. Find 28 % of 7500 bushels of oats.

```
75 00 bu.
    .28
 600 00
1500 0
2100.00 bu.
```

Since per cent means hundredths, 28 % of 7500 bushels equals .28 of 7500 bushels, or 2100 bushels.

Find:

2. 27 % of $395   **7.** 35 % of $90.60   **12.** 75 % of $605

3. 14 % of $478   **8.** 40 % of $20.50   **13.** 37 % of $2005

4. 24 % of $527   **9.** 10 % of $2004   **14.** 45 % of $6745

5. 6 % of $57.40   **10.** 5 % of $200.60   **15.** 80 % of $905

6. 5 % of $90.80   **11.** 7 % of $500.50   **16.** 98 % of $7008

17. Mr. Ford bought a horse for $175 and sold it for 90 % of the cost. For how much did he sell the horse?

18. The distance between two cities was 1080 miles. After 45 % of the distance had been traveled, how much of the distance had been traveled?

19. One year Mr. Field spent $1560. The next year his cost of living increased 24 %. How much did he spend the second year?

20. The salary of a school teacher last year was $80 a month, and this year her salary was increased 25 % of last year's salary. Find the monthly amount of increase.

21. Paul lived 560 rd. from the school and David 72 % as far. Find how far from the school David lived.

22. A family of five, with an income of $120 a month, spent 30 % for food; 20 % for rent; 10 % for heat, light, and laundry; 15 % for clothing, and the rest for miscellaneous items. How much was spent for each item?

** — 12

ACCOUNTS, BILLS, RECEIPTS

CASH ACCOUNTS

A statement of money received and expended is a **cash account.**

There are two sides to every account. On the left-hand side are entered all the receipts as well as cash on hand at the beginning; on the right-hand side are entered all payments and the difference between the receipts and the payments, which is called the **balance.** The balance is written also on the left-hand side, below the sum of the receipts. If the work is correct, the sum of the payments plus the balance equals the sum of the receipts.

The following is a cash account of a schoolboy:

Notice that the sum of payments plus the balance $10.62 = $13.50, the sum of the left-hand column.

1918		RECEIPTS			1918		PAYMENTS		
Sept.	2	Cash on hand	10	65	Sept.	3	Notebook		20
	5	Errand		10		4	Arithmetic		50
	7	Selling papers		25		5	Geography	1	00
	13	Gift	1	00		6	Ink and pens		18
	24	Mowing Lawn		75		12	History	1	00
	27	Cleaning cellar		75		29	**Balance**	10	62
			13	50				13	50
		Balance	10	62					

178

The following form may be used, if preferred :

Date	(Item)	Received	Paid

Written Work

John Hoyt started an account with a birthday gift of $10.00 received Oct. 1, 1918. Balance the account for each month to Oct. 1, 1919.

1. *October*, 1918. Oct. 1, Birthday gift, $10.00. Oct. 8, Bought 1 pair of slippers, $1.98; 1 hat, $1.50. Oct. 8, Repairs to bicycle, $.75. Oct. 19, Earned $2.35.

2. *November*. Nov. 5, Bought a sled, $.95. Nov. 11, Bought a cap, $.75. Nov. 15, Shoveled snow, $.30. Nov. 18, Sawed wood, $.50. Nov. 26, Bought a knife, $.25.

3. *December*. Dec. 3, Bought 1 pair of skates, $.75. Dec. 14, Earned by work in store, $1.00. Dec. 17, Paid for pad, $.17. Dec. 22, Received for carrying bags, $.30. Dec. 23, Bought Christmas presents, $3.75. Dec. 25, Christmas gift, $5.00. Dec. 30, Paid for sharpening skates, $.10.

4. *January*, 1919. Jan. 4, Received for repairing doorbell, $.15. Jan. 8, Bought 1 pair mittens, $.50. Jan. 18, Earned by collecting bills, $.50. Jan. 27, Bought necktie, $.25. Jan. 30, Bought books, $.75.

5. *February*. Feb. 8, Earned by work in store, $.75. Feb. 11, Shoveled snow, $.25. Feb. 17, Ran errands, $.40. Feb. 20, Earned by errands, $1.00. Feb. 26, Copied 2 leases, $.75.

6. *March*. March 1, Cleaned yard, $.50. March 6, Bought 1 pair of socks, $.30. March 11, Bought new umbrella for mother, $1.75. March 15, Repaired fence, $.25. March 27, Car fare, $.30.

7. *April.* **Apr. 1,** Burned refuse, $.25. **Apr. 8, Made** garden, $1.50. **Apr. 10,** Cleaned cellar, $.35. Apr 15, Wheeled load of coal, $.35. Apr. 25, Bought 4 collars and **2 pairs** of cuffs, $.90. Apr. 28, Bought 1 doz. pencils $.35 **and 1 pad $.18.**

8. *May.* May 3, Bought straw hat, $1.00. May 7, Mowed lawn, $.25. May 13, Repaired bell, $.40. May 29, Bought baseball, $.50. May 30, Received a reward of $5.00 for returning a lost pocketbook to owner. May 31, **Bought necktie, $.48.**

9. *June.* June 2, Made $.20 selling papers. **June 7,** **Earned** by work in store, $.75. June 10, Delivered package, **$.25.** June 17, Bought ball bat, $.50. June 20, Wheeled **a trunk, $.25.** June 30, Bought 1 pair of baseball shoes, **$1.00.**

10. *July.* July 4, Paid for fireworks, $.50. July 5, Received week's salary, $5.00. July 11, Bought 2 shirts, **$1.50.** July 12, Received week's salary, $5.00. July 15, Bought outing suit, $6.50. July 19, Received week's **salary, $5.00.** July 26, Received salary, $5.00.

11. *August.* Aug. 2, Received salary, $5.00. Aug. 8, **Bought** 1 dozen handkerchiefs, $2.50. Aug. 9, Received **salary, $5.00.** Aug. 15, Bought fishing tackle, $3.75. Aug. 16, Received salary, $5.00. Aug. 30, Expenses for **two** weeks' vacation, $15.55.

12. *September.* Sept. 1, Received gift, $5.00. **Sept. 6,** **Paid** for stationery, $1.65. Sept. 26, Paid for books, $2.10. **Sept. 30,** Earned by delivering parcels, $.50.

Oct. 1, Balance, Cash on hand, ———.

Make out a statement, showing the total receipts and disbursements for the year, and proving the final balance.

BILLS

A written statement, in detail, of goods sold or of services rendered is called a **bill**.

The person who owes the amount of the bill is called the **debtor** (Dr.) and the person to whom he owes the amount is called the **creditor** (Cr.).

The following is a common form of bill.

Los Angeles, Calif., Feb. 1, 1919

Mrs. Paul Steele,
    42 Market Street

Bought of L. S. FORD AND COMPANY,
605 Main Street

TERMS: *Cash*

Jan.	4	10 yd. Serge	$1.75	$17	50		
		3 doz. Buttons	.06¼		19		
		20 yd. Braid	.07½	1	50		
						19	19

Received payment
    L. S. Ford and Company
        per J. B.

When a clerk receives payment, he writes the receipt of the firm, and the word *per* followed by his own name or initials

Every bill should show: the *place* and the *date* of purchase; the *names* of *buyer* and *seller;* the *quantity*, the *price* and the *cost* of each item, and the *amount* of the bill.

Write bills for purchases made in five different stores.

Some **abbreviations** used in business:

Acct. %,	account	mdse.,	merchandise
Amt.,	amount	No. (#),	number
bal.,	balance	paym't,	payment
Co.,	company	pd.,	paid
Cr.,	creditor	per,	by
Dr.,	debtor	pc.,	piece
do ("),	the same	rec'd,	received

The sign @ means "at so much a unit." "3 yd. @ $.75," means "3 yd. at $.75 a yard."

The symbol # means *pounds* when placed *after* a number, but *number* when placed *before* a number.

Thus 6 # means 6 pounds, but # 6 means Number 6.

1. Copy some bills received from your grocer, your butcher, or your coal dealer, and fill in some of the actual purchases that your parents have made.

2. Let the teacher be represented as owning a grocery store, a butcher shop, a coal yard, or a dry-goods store, and let the pupils be the purchasers. Fill out blank bill heads, giving date and day of purchase, amount and price of purchase, and receipt for payment.

3. Walter prepares to raise garden vegetables. He buys at the grocery store: 1½ bu. potatoes @ $1.25; 3 qt. small onions @ 15 ¢; 1 package onion seed @ 20 ¢; 1 package lettuce seed @ 10 ¢; 1 package lima bean seed @ 10 ¢; 1 package pea seed @ 10 ¢. He pays cash. Make out and receipt the bill, using your local grocer's name.

4. John and William agree to repair Mrs. Brown's lawn. They work four days each at $1 a day each. They furnish $2 worth of sod and 75 ¢ worth of lawn seed. Mrs. Brown asks them to make out a bill, and pays them April 15th. Write the bill and receipt it.

7. Philip Austin works for 10 days for Mrs. Elliott Keller, repairing the lawn and a fence. He receives $2.50 a day and furnishes 150 ft. of lumber at 6¢ a foot; 1 gal. paint $4.00; 1 paint brush 90¢; and 4 lb. nails @ 10¢. Make out and receipt the bill if paid April 20.

8. Walter buys at the hardware store April 10, a rake for 80¢; a hoe for 85¢; a cultivator for $4.50; a bushel basket for 35¢. Make out and receipt the bill.

9. Mr. Smith makes the following purchases at a hardware store: 1 saw @ 75¢; 3 gas heaters @ $4.90; 3½ doz. screws @ 12¢; 10½ lb. lawn seed @ 20¢; 8 joints stove pipe @ 30¢; 2 elbows @ 40¢. Fill in the name of your local hardware merchant, and receipt the bill, if cash is paid at the time of the purchase.

Make out receipted bills for the following sales made at current prices:

8. 3½ lb. rice   **9.** 12 yd. muslin
    10 lb. prunes   10 yd. lace
    2 bags salt   2 pair socks

10. William Thomas buys of Arnold and Barret Company, Minneapolis, Minn., Oct. 10, 1919, 15 lb. butter at 58¢ a pound; 10 doz. eggs at 59¢ a dozen. Make out the receipted bill, representing yourself as clerk.

11. T. S. Ball owes Dr. S. N. Pool, Seattle, Wash., for services as follows: Jan. 1, to 1 call, $4; Jan. 12, to 1 call, $2; Jan 14, office, $1; Jan. 17, to 1 call, $2. Make out and receipt the bill if paid Feb. 1.

12. Mr. John Dunn, Lima, Ohio, buys from Arnold and Blake, Lima, Ohio, 36 bbl. of apples @ $4.80; 4 boxes of prunes @ $1.65; 500 lb. of coffee @ 21⅜¢; 7 boxes of yeast @ 75¢; 50 lb. of cocoa @ 32¢.

RECEIPTS

Written Work

Sometimes a **receipt** like the following is written instead of a receipted bill.

$___50 $\frac{00}{100}$___	*Louisville, Ky., Sept. 1, 1919*
Received from_____*Arthur Hill*_____
~~*Fifty and $\frac{75}{100}$*~~~~~~~~~~***Dollars***
*for*_____*Rent for September 1919*_____
_____*George Warren*_____

1. Write the receipt your grocer would give you in payment of $18.50 on account.

2. Henry Smith receives $75 from James Brown for 3 months' rent. Make out a receipt for the amount.

3. Ralph Taylor pays H. W. Henderson $25 for a month's tuition. Write the receipt Ralph Taylor should receive.

4. Mr. John Wylands has a reservoir that supplies several families with water. Charles Hoffman owes him $6.75 water rent for January, February, and March, 1919. Write Mr. Wyland's receipt for payment April 1, 1919.

5. Make out and receipt the bill for the following articles:

3 shirts @ $1.75		2 neckties @ $.75	
6 collars @ .20		4 pairs cuffs @ .20	

6. Make out a receipt to a subscriber who has paid you $2.60 in full for account for newspapers.

7. John Orr sells $35 worth of coal to Paul Hart. The bill is paid January 20. Write the receipt.

CHECKS

Oral and Written Work

An order on a bank where a person keeps a deposit, **directing** the bank to pay money, is called a **check**.

STUB	CHECK

$67.75 *No. 34*	*No. 34*		
Jan. 10, 1919	*Detroit, Mich., Jan. 10, 1919*		
To... *James Ward*	The First National Bank.		
For ..... *Suit*	PAY TO THE		
Bal. for'd	95	56	Order of..... *James Ward* $67⁷⁵
Am't this check	67	75	*Sixty-seven and* $\frac{75}{100}$ ~~~~~Dollars.
Bal. for'd	27	81	*W. J. Moore*

1. Name the different things stated in this check.

2. Observe that this check is payable to the order of James Ward. He orders it paid by writing his name across the back of it. This is called **indorsing** the check.

When a check has been cashed at the bank, it is canceled and returned to the maker. It is then called a **voucher.** Such vouchers serve as receipts. When a bill is paid by check, it is not customary to demand a receipt.

3. The **stubs** remaining in a check book after the checks are torn out give a record of the checks issued. What else does the stub in the figure show?

4. Write a check for $18 payable to Paul Burt.

5. Edwin Scott works for John D. Walker, and receives a check on a local bank for $20. Write the check.

6. Name a bank after your town, and write checks on it in payment of the bills on the previous pages.

EVERYDAY MEASUREMENTS

We measure the quantity of anything by finding how many times it contains some unit of the same kind, called the **unit of measure.**

The standard or principal units of capacity, length, weight, and time are as follows:

Liquid — **gallon.**   Length or distance — **yard.**
Dry — **bushel.**   Avoirdupois — **pound (16 oz.).**

Time — **day.**

Most other common measures are determined from the above unit measures. Thus, 1 ton = 2000 times 1 pound (16 oz.); 1 hour = $\frac{1}{24}$ of 1 day, the period of one revolution of the earth on its axis; 1 quart = $\frac{1}{4}$ of 1 gallon; 1 inch = $\frac{1}{36}$ of 1 yard, etc.

A concrete number whose unit is a measure established by custom or by law is called a **denominate number.**

In 10 feet, 1 foot is the unit of measure; in 5 pounds, 1 pound is the unit of measure; in 12 bushels, 1 bushel is the unit of measure, etc.

A number of one denomination is called a **simple denominate number.**

Thus, 12 rods; 2 ounces; 15 days; 16 pounds; 25 gallons; 16 hundredweight, etc., are simple denominate numbers.

A number composed of two or more concrete numbers that express one quantity is called a **compound denominate number.**

Thus, 6 yards 2 feet 4 inches is a compound denominate number (yards, feet, and inches being used to express a single quantity); also 5 bushels 3 pecks 4 quarts (bushels, quarts, and pecks being used to express a single quantity).

LIQUID MEASURES

Oral Work

Liquid measures are used in measuring **milk, oil, vinegar, and** other liquid articles.

TABLE

4 gills	**= 1 pint (pt.)**
2 pints	**= 1 quart (qt.)**
4 quarts	**= 1 gallon (gal.)**
$31\frac{1}{2}$ **gallons**	**= 1 barrel (bbl.)**
63 gallons	**= 1 hogshead (hhd.)**
1 gallon	**= 231 cubic inches**
1 gal. = 4 qt. = 8 pt. = 32 gi.	

1. 4 gal. = —— qt.

2. 5 gal. = —— pt.

3. 4 pt. = —— gi.

4. 2 bbl. = —— gal.

5. 16 qt. = —— gal.

6. 8 pt. = —— qt.

7. 16 pt. = —— gal.

8. 8 gi. = —— pt.

Written Work

1. Change 18 gal. 3 qt. to quarts.

18
4
——
72
3
——
75 (qt.)

Since there are 4 qt. in 1 gal., 18 gal. = 18 × 4 qt. or 72 qt.   72 qt. + 3 qt. = 75 qt.

Notice that although in the explanation 4 qt. is the multiplicand and 18 the multiplier, in actual written work the numbers are regarded as abstract and the smaller factor is used, for convenience, as the multiplier.   Much of the work in reduction can, however, be done mentally.

Change :

2. 6 gal. 1 pt. to pints.   4. 4 gal. 3 pt. to pints.

3. 8 gal. 1 qt. to quarts.   5. 5 gal. 1 pt. to pints.

6. Change $\frac{7}{8}$ gal. to quarts and pints.

$\frac{7}{8}$ gal. $= \frac{7}{8}$ of 4 qt., or $3\frac{1}{2}$ qt.

$\frac{1}{2}$ qt. $= \frac{1}{2}$ of 2 pt., or 1 pt.

$\frac{7}{8}$ gal. $= 3$ qt. 1 pt.

First change $\frac{7}{8}$ gal. to quarts.
Then change $\frac{1}{2}$ qt. to pints.

Change :

7. $\frac{3}{4}$ gal. to quarts.   9. $\frac{3}{4}$ qt. to pints.   11. $3\frac{3}{4}$ qt. to pints.

8. $\frac{1}{2}$ gal. to pints.   10. $\frac{7}{8}$ qt. to pints.   12. $1\frac{7}{8}$ qt. to pints.

13. Change 127 pt. to gallons and quarts.
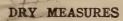
8)127 (pt.)
   15, no. gal.; r. 7 (pt.)
   2)7 (pt.)
   $3\frac{1}{2}$, no. qt.

Since 8 pt. = 1 gal., 127 pt. =
15 gal. with 7 pt. remaining.
Since 2 pt. = 1 qt., 7 pt. = $3\frac{1}{2}$ qt.
        Ans. 15 gal. $3\frac{1}{2}$ qt.

14. 376 pt. to gallons.   19. 8 qt. 4 pt. to pints.

15. 276 qt. to gallons.   20. 15 gal. 5 qt. to quarts.

16. 12 gal. 1 qt. to quarts.   21. 80 pt. to gallons.

17. 10 qt. 2 pt. to pints.   22. 37 pt. to quarts.

18. 7 gal. 3 qt. to quarts.   23. 100 pt. to gallons.

24. John sells 50 pt. of milk at 16 ¢ a quart. How many gallons and quarts remaining does he sell, and how much does he receive for the milk?

25. Mrs. Smith buys 2 gal. lamp oil. How many days will it last if she uses 1 pt. a day?

26. How many gallons of milk are consumed by a family in 75 days, if they use $2\frac{1}{2}$ qt. daily?

27. A tank in an oil field holds 7500 gal. of crude oil. How many barrels of 42 gal. each does it hold?

28. Henry works in his father's sugar camp in the spring, and for his share of the work he receives 8 gal. of maple sirup, which he retails in quart bottles at 75¢ a quart. For how much does he sell the maple sirup?

29. A milkman has a can of milk containing 10 gal. If he sells 5 qt. to his first customer, 4 qt. to the second customer, 4 gal. to the third customer, and 3 gal. 1 pt. to the fourth, how much has he left in the can?

DRY MEASURES

Oral Work

Dry measures are used in measuring grain, fruit, roots, and other dry articles. Name five articles sold by the bushel.

TABLE

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)
1 bushel	= 2150.42 cubic inches
1 bu. = 4 pk. = 32 qt. = 64 pt.	

1. 1 bu. = — pt. = — qt.

2. 5 bu. = — pt.

3. 4 bu. = — qt.

4. 6 pk. = — qt.

5. 64 pt. = — bu.

6. 64 qt. = — bu.

7. 16 pk. = — bu.

8. 32 qt. = — pt.

9. 14 pt. = — qt.

10. 48 pt. = — qt.

11. 10 pk. = — pt.

12. 12 bu. = — qt.

13. 16 bu. = — pk.

Written Work

Change :

1. 7 bu. 3 pecks to pints.
2. 8 pk. 3 qt. to quarts.
3. 5 bu. 1 qt. to quarts.
4. 14 bu. 4 pk. to pecks.
5. $\frac{7}{8}$ bu. to pecks.
6. $8\frac{3}{4}$ pk. to quarts.
7. $1\frac{1}{8}$ bu. to pecks.
8. $3\frac{1}{2}$ pk. to quarts.
9. 18 pt. to quarts.
10. 32 qt. to bushels
11. 16 qt. to pecks.
12. 18 pk. to bushels.

13. James picked 20 qt. of cranberries. How many pecks did he pick ? How many pints did he pick ? He sold the cranberries at 8 ¢ a quart. How much did he receive for them ?

14. During one week John picked peaches as follows: Monday, 2 pk.; Tuesday, 3 pk.; Wednesday, $2\frac{3}{8}$ pk.; Thursday, 1 bu. ; Friday, $1\frac{3}{32}$ bu.; Saturday, $3\frac{3}{8}$ pk. Find the number of bushels and pecks he picked during the week.

15. James had a chestnut tree. He gathered in all 1 bu. 3 qt. of chestnuts from the tree. How many pints did he gather ?

16 Mary's mother gave her the apples on a certain tree to sell. Mary sold at six different times : 1 pk., $\frac{1}{2}$ pk., $\frac{1}{4}$ pk., $\frac{1}{2}$ pk., $1\frac{1}{2}$ pk., 1 bu. How many bushels and pecks of apples did she sell ? How much did she receive for them at $2 a bushel?

17. How many bushels of potatoes were necessary to plant $8\frac{7}{8}$ acres, allowing 6 bu. 1 pk. to the acre ?

18. Walter picked $4\frac{1}{4}$ bu. of apples and sold them to a grocer for 6 ¢ a quart. He took in exchange coffee at 24 ¢ a pound. How many pounds of coffee did he receive ?

MEASURES OF WEIGHT

Oral Work

Note. Secure a scale and weights, and weigh articles of different kinds.

Avoirdupois weight is used in weighing heavy articles; as groceries, coal, grain, and metals, except gold and silver.

TABLE

16 ounces (oz.)	= 1 pound (lb.)
100 pounds	= 1 hundredweight (cwt.)
20 hundredweight	= 1 ton (T.)
2000 pounds	
2240 lb.	= 1 long ton

1 T. = 20 cwt. = 2000 lb.

The avoirdupois pound contains 7000 grains; and the avoirdupois ounce, $437\frac{1}{2}$ grains.

The unit of avoirdupois weight is the **pound**.

The long ton is used at the United States custom houses, and in wholesale transactions in coal and iron.

1. 1 T. = —— cwt. = —— lb. = —— oz.

2. 3 T. = — lb.   5. 5 lb. = — oz.   8. 64 oz. = — lb.

3. 32 oz. = — lb.   6. 2 T. = — lb.   9. 80 cwt. = — T.

4. 4 cwt. = — oz.   7. 10 lb. = — oz.   10. 400 lb. = — cwt.

Note. A short method of estimating prices of hay is so much a pound. Hay at $10 a ton is $\frac{1}{2}$¢ a pound. Hay at $20 a ton is 1¢ a pound, and hay at $30 a ton is $1\frac{1}{2}$¢ a pound.

Find the cost of these quantities of hay at $20 a ton:

11. 8 cwt.   14. 1 T. 6 cwt.   17. 950 lb

12. 650 lb.   15. 1275 cwt. 75 lb.   18. 5 cwt.

13. 3 bales, 90 lb. each.   16. 2 bales, 70 lb. each.   19. 7 cwt.

Written Work

Change:

1. 6 lb. 5 oz. to ounces.

2. 3 T. 8 cwt. to pounds.

3. 3600 lb. to hundredweight.

7. Change $\frac{5}{16}$ of a ton to hundredweight and pounds.

4. 544 oz. to pounds.

5. 6000 lb. to tons.

6. $4\frac{4}{5}$ T. to pounds.

$\frac{5}{16}$ T. $= \frac{5}{16}$ of 20 cwt. $= 6\frac{1}{4}$ cwt.

$\frac{1}{4}$ cwt. $= \frac{1}{4}$ of 100 lb. $= 25$ lb.

$\frac{5}{16}$ of a ton $= 6$ cwt. 25 lb.

First change tons to hundredweight. Then change the $\frac{1}{4}$ cwt. to pounds.

Change:

8. $\frac{1}{2}$ cwt. to pounds.

9. $\frac{7}{8}$ T. to pounds.

10. $\frac{3}{4}$ lb. to ounces.

11. $\frac{7}{16}$ T. to cwt. and pounds.

12. At 65 ¢ a pound, how much do 10 oz. of tea cost? How much do 1 lb. 8 oz. cost?

13. Find the cost of 125 lb. of potatoes at $ 3.00 a hundredweight; of 75 lb. at $ 2.75 a hundredweight.

14. A wagon loaded with potatoes weighs 4200 lb. If the wagon weighs 1200 lb., how many tons and hundredweight of potatoes are there?

15. A grain dealer buys 50 sacks of grain, averaging 90 lb. to a sack. How many hundredweight of grain does the dealer buy?

16. 50 cwt. of starch is packed in boxes, each containing 10 lb. How much is received, if each box is sold for 12 ¢?

17. A Kentucky farmer clips $241\frac{1}{2}$ lb. of mohair from 70 Angora goats. Find the average clip from each of the goats.

WEIGHTS PER BUSHEL

Oral and Written Work

TABLE

	PER BUSHEL		PER BUSHEL
Wheat	60 lb.	Onions	57 lb.
Buckwheat	48 lb.	Irish Potatoes	60 lb.
Oats	32 lb.	Sweet Potatoes	55 lb.
White Beans	60 lb.	Corn, in ear	70 lb.
Turnips	55 lb.	Corn, shelled	56 lb.
Flaxseed	56 lb.	Rye	56 lb.
Clover Seed	60 lb.	Timothy Seed	45 lb.
Barley	48 lb.	Winter Apples	48 lb.

Find the weight of:

1. $\frac{1}{2}$ pk. of Irish potatoes.
2. $\frac{1}{2}$ pk. of sweet potatoes.
3. $\frac{1}{2}$ pk. of shelled corn.
4. $\frac{1}{4}$ pk. of oats.
5. $\frac{1}{2}$ pk. of barley.
6. $\frac{3}{4}$ pk. of white beans.
7. $\frac{1}{4}$ pk. of rye.
8. $\frac{1}{2}$ pk. of winter apples.
9. $\frac{1}{2}$ pk. of corn in ear.
10. $\frac{1}{2}$ pk. of flaxseed.
11. 8 pk. of clover seed.
12. 8 pk. of barley.

13. Mr. Long threshed 37 bu. per acre of buckwheat on $8\frac{3}{4}$ acres. What was the weight of the buckwheat?

14. A farmer raised 4800 bu. of barley. How many pounds did he raise?

15. Estimate the number of bushels of shelled corn, corn in the ear, oats, wheat, or rye, that a car having 60,000 lb. capacity would hold.

16. John took a load of Irish potatoes to the market. He found that the wagon and the potatoes weighed 3000 lb. If the wagon weighed 1200 lb., how many bushels of potatoes did he have?

* * — 13

MEASURES OF LENGTH

Oral Work

A tapeline 50 feet to 100 feet in length, marked in feet and tenths and hundredths of a foot, is commonly used for measuring short distances.

TABLE

12 inches (in.)	**= 1 foot (ft.)**
3 feet	**= 1 yard (yd.)**
5½ yards, or 16½ feet	**= 1 rod (rd.)**
320 rods	**= 1 mile (mi.)**
1760 yards = 1 mile	**5280 feet = 1 mile**

1. 1 mi. = —— rd. = —— yd. = —— ft. = —— in.

2. 3 ft. = —in. **5.** 36 in. = —ft. **8.** 640 rd. = —mi

3. 4 rd. = —ft. **6.** 12 ft. = —yd. **9.** 4 ft. = — in.

4. 2 mi. = —rd. **7.** 33 ft. = —rd. **10.** 5 yd. = —ft.

Written Work

Change:

1. 1 rd. 2 ft. to feet.   **5.** 5 mi. 4 rd. to rods.

2. 10 ft. 6 in. to inches.   **6.** ¾ mi. to rods.

3. 12 rd. 3 yd. to yards.   **7.** 60 in. to feet.

4. 1 yd. 7 in. to inches.   **8.** 144 in. to yards.

9. In an automobile race the fastest machine ran ⅞ mi. in 36 sec. Find the number of feet it ran per second.

10. A bicycle wheel was 7 ft. 4 in. in circumference. How many turns did it make in going 6 mi.?

11. How many feet of fence were needed to inclose a square field, each side of which was 22 rd.?

MEASURES OF TIME

Oral Work

TABLE

60 seconds (sec.)	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day (da.)
7 days	= 1 week (wk.)
365 days	= 1 year (yr.)

April, June, September, and November have each 30 days. All the others except February have 31 days each. February usually has 28 days. A year that has 366 days is called a leap year. In leap year February has 29 days.

NOTE. Centennial years divisible by 400, and other years divisible by 4, are leap years. Thus, 1600 and 1916 were leap years, but not 1900.

1. 5 min. = —— sec.

2. 6 hr. = —— min.

3. 4 da. = —— wk.

4. 120 sec. = —— min.

5. 48 hr. = —— da.

6. 2 yr. = —— da.

7. 5 wk. = —— da.

8. 2 da. = —— hr.

Written Work

Change:

1. 3 hr. 6 min. to minutes.

2. 5 da. 3 hr. to hours.

3. 12 wk. 6 da. to days.

4. 30 min. 20 sec. to seconds.

5. $\frac{3}{4}$ wk. to days.

6. $\frac{3}{4}$ hr. to minutes.

7. 180 sec. to minutes.

8. 28 da. to weeks.

9. 72 mo. to years.

10. 72 hr. to days.

11. Make a calendar for November of this year, abbreviating the days of the week.

12. A train goes 104 miles in 3 hr. 15 min. What is its rate per hour?

13. A man works 9 hr. a day in summer, and 8 hr. a day in winter. If his wages in summer are $4.50 a day, at the same rate find his wages per day in winter.

14. If a watch gains 18 seconds in a day, how much too fast will it be in 3 weeks?

15. An automobile runs $2\frac{7}{8}$ mi. in 5 min. At that rate, find the distance in miles and rods it runs in 1 hr. 35 min.

16. Mary walks $\frac{3}{4}$ mi. to school each day. How many miles does she walk in going to and from school in 180 da.?

17. Henry walks 80% of the distance Mary walks each day. How far does Henry walk in a term of 160 da.?

18. At 20 cents an hour, how much does a boy earn in 26 da., working each day from 8 A.M. to 5 P.M., allowing 1 hr. for lunch?

19. If a flour mill grinds wheat at the rate of 1 pt. in 5 sec., in how many hours will it grind 21,600 bu.?

20. An 11-hour train between two cities 430 miles apart starts 1 hr. late. How much must it increase its speed to arrive on time?

On schedule time it averages (430 mi. ÷ 11) per hour; when late, (430 mi. ÷ 10) per hour.

21. A train running 1320 mi. in 24 hr. starts $\frac{1}{2}$ hr. late. How much must it increase its speed to arrive on time?

COUNTING AND STATIONERS' TABLE

Oral and Written Work

TABLE

12 things	= 1 dozen
12 dozen	= 1 gross
24 sheets paper	= 1 quire
20 quires	= 1 ream
20 things	= 1 score

1. Find the cost of 1 gross of buttons at 15 ¢ a dozen?

2. A stationer buys 12 quires of paper for $2.40 and sells it at 2 ¢ a sheet. How much does he gain?

3. Find the cost of 40 lemons at 30 ¢ a dozen.

4. If oranges cost 40 ¢ a dozen, how much does 1 cost?

5. Thomas buys a box of pens containing one gross. How many dozen does he get? How much are they worth at 5 ¢ a dozen?

6. A dealer buys pens at 80 ¢ a gross, and sells them at 1 ¢ apiece. Find his profit per dozen.

7. Mr. Jones is 4 score and 6 years old. How old is he?

8. A grocer buys eggs at 35 ¢ a dozen, and retails them at 48 ¢ a dozen. What is the gain on each egg?

9. How much do $1\frac{1}{2}$ doz. tablets cost at 12 ¢ apiece? If the dealer sells them at 15 ¢ apiece, what is his profit?

10. How much must be paid for 15 gross of lead pencils at 35 ¢ a dozen?

OPERATIONS WITH DENOMINATE NUMBERS

NOTE. Operations with compound denominate numbers are usually performed by reducing all the numbers to simple numbers of like denomination and then adding, subtracting, multiplying, or dividing.

Written Work

1. Find the sum of 3 hr. 45 min. and 1 hr. 15 min.; find the difference between 3 hr. 45 min. and 1 hr. 15 min.

$$3 \text{ hr. } 45 \text{ min.} = 3\frac{3}{4} \text{ hr.,} \qquad 3\frac{3}{4} \text{ hr.}$$
$$1 \text{ hr. } 15 \text{ min.} = 1\frac{1}{4} \text{ hr.} \qquad 1\frac{1}{4} \text{ hr.}$$
$$5 \text{ hr., Sum} \qquad 2\frac{2}{4} \text{ hr.} = 2\frac{1}{2} \text{ hr., Difference}$$

2. John sold a fish that weighed 12 lb. 8 oz. at 24 ¢ a pound. How much did he receive for it?

SOLUTION. 12 lb. 8 oz. $= 12\frac{1}{2}$ lb.; $12\frac{1}{2} \times 24 \not{c} = \$3.00$

3. A farmer sold 15 lb. 8 oz. of butter for $7.44. What was the price per pound?

SOLUTION. 15 lb. 8 oz. $= 15\frac{1}{2}$ lb.
$7.44 \div 15.5 = \$.48$, price per pound.
Or, 15 lb. 8 oz. $= 248$ oz.; $7.44 \div 248 = \$.03$, price per ounce.
$16 \times \$.03 = \$.48$, price per pound.

First add; then subtract:

4. 5 ft. 9 in., 4 ft. 10 in.

5. 8 lb. 8 oz., 4 lb. 12 oz.

6. 16 gal. 2 qt., 5 gal. 3 qt.

7. 12 bu. 5 pk., 6 bu. 3 pk.

8. 8 T. 6 cwt., 5 T. 5 cwt.

9. 7 wk. 2 da., 2 wk. 4 da.

10. 15 pk. 4 qt., 8 pk. 6 qt.

11. 5 yd. 6 in., 3 yd. 9 in.

12. 8 gross 3 doz., 7 gross 5 doz.

13. 10 hr. 30 min., 4 hr. 45 min.

Perform the operations indicated:

14. 34×2 ft. 6 in.   19. 5 hr. 45 min. $\div$ 15

15. 16×3 lb. 4 oz.   20. 12 ft. 8 in. $\div$ 12

16. 15×12 gal. 1 qt.   21. 4 gal. 2 qt. $\div$ 3

17. 10×4 wk. 3 da.   22. 5 T. 200 lb. $\div$ 50

18. 16×5 T. 3 cwt.   23. 12 yd. 9 in. $\div$ 4

Find the missing numbers:

	WEIGHT	PRICE PER POUND	AMOUNT		WEIGHT	PRICE PER POUND	AMOUNT
24.	2 lb. 6 oz.	8¢	?	32.	?	32¢	48¢
25.	3 lb. 12 oz.	12¢	?	33.	?	16¢	49¢
26.	4 lb. 14 oz.	16¢	?	34.	3 lb. 8 oz.	?	63¢
27.	3 lb. 9 oz.	32¢	?	35.	16 lb. 10 oz.	16¢	?
28.	8 lb. 6 oz.	20¢	?	36.	4 lb. 12 oz.	?	95¢
29.	5 lb. 10 oz.	30¢	?	37.	5 lb. 8 oz.	?	44¢
30.	7 lb. 12 oz.	18¢	?	38.	10 lb. 10 oz.	10¢	?
31.	6 lb. 13 oz.	24¢	?	39.	?	24¢	78¢

The **difference between two dates** is sometimes found by subtraction of denominate numbers.

40. Find the difference in time between November 15, 1917, and August 12, 1919.

yr.	mo.	da.
1919	8	12
1917	11	15
1	8	27

Aug. 12, 1919, is represented as the 12th day of the 8th month of 1919, and Nov. 15, 1917, as the 15th day of the 11th month of 1917.

1 mo., or 30 da., + 12 da. = 42 da.; 42 da. − 15 da. = 27 da.; 1 yr., or 12 mo., + 7 mo. = 19 mo.; 19 mo. − 11 mo. = 8 mo.; 1918 yr. − 1917 yr. = 1 yr.

Subtract:

	yr.	mo.	da.
41.	1920	7	12
	1913	9	15

	yr.	mo.	da.
42.	1919	9	1
	1904	8	15

NOTE. This method of subtraction of dates gives only approximate results, since it assumes that each month contains 30 days.

43. The World War broke out on Aug. 4, 1914, and the armistice was signed Nov. 11, 1918. What was the time between these dates?

44. Woodrow Wilson was born Dec. 28, 1856. How old was he when he sailed to France for the Peace Conference, Dec. 4, 1918? when he died, Feb. 3, 1924?

45. Louisa M. Alcott was born Nov. 29, 1832. How old was she at the time of her death, March 6, 1888?

46. Theodore Roosevelt was born Oct. 27, 1858. He died Jan. 6, 1919. How old was he at the time of his death?

47. Find the time from the signing of the Declaration of Independence, July 4, 1776, to the beginning of the Civil War, April 12, 1861.

48. Ulysses S. Grant was born April 27, 1822. How old was he when the Civil War closed, April 9, 1865?

49. Abraham Lincoln was born Feb. 12, 1809, and died April 15, 1865. How old was he at the time of his death?

50. Grover Cleveland was born March 18, 1837, and died June 24, 1908. How old was he at the time of his death?

51. Washington Irving was born April 3, 1783, and died Nov. 28, 1859. How old was he when he died?

NOTE. The exact time between two dates less than a year apart is found by counting the actual number of days in each month. Thus, the time between April 10 and July 4 is 85 days (20 days in April, 31 days in May, 30 days in June, and 4 days in July). Find the exact time in Ex. 52 and 53.

52. Thomas borrowed $800 from his father on May 5, 1919, and repaid it Feb. 12, 1920. For how long did he borrow the money?

53. Martha left home to visit her aunt, June 16, 1919, and returned March 2, 1920. How long was she away from home?

VARIOUS MEASURES

1. A seed company puts up 4-quart packages. Find the number of packages that can be put up out of 48 bu. of onion seeds.

2. Arthur Jones orders $4\frac{3}{4}$ T. of sand at $1.15 per ton. How much will it cost? How many pounds of sand does he get?

3. Mrs. Peck receives the weight checks for two loads of hard coal, 4000 lb. and 3000 lb. How much does she pay for the coal at $8.50 per ton?

4. Mrs. Williams puts up 149 qt. of berries during the summer. How many gallons and quarts does she put up?

5. James, Mary, Martha, and John pick strawberries as follows: 144 qt., 156 qt., 168 qt., and 192 qt. How many small crates containing 12 qt. each could be filled with the amount each one picks? how many large crates containing 16 qt. each?

6. James makes it a rule to study 1 hr. 15 min. each school day during a term of 180 days. How many hours does he study during the term?

7. John's horse eats 1 bu. 3 pk. of oats a week. How much does he eat in 30 days?

8. The posts in an iron fence around a school yard 10 rd. square are 8 ft. 3 in. apart. How many posts are needed?

9. The curbstones along Mr. Thomas's lot are 3 ft. 4 in. in length. If the lot has $133\frac{1}{3}$ feet frontage, how many curbstones are there?

10. Frank lives 1 mi. 270 rd. south of the schoolhouse, and Arthur 56 rd. north of the schoolhouse. How much farther does Frank live from the schoolhouse than Arthur? How far apart do they live?

11. Mary works for her mother 1 hr. 20 min. after school each day. How many days' work of 8 hr. each does this amount to in 180 days?

12. Frank delivers to Mrs. Dent 1 qt. of milk each day for 13 weeks, and to Mrs. Brown 3 qt. for 10 weeks. If he gets 14 ¢ a quart for the milk, find the amount he receives

13. Paul is 5 ft. 7¾ in. tall and his father is 5 ft. 11⅞ in tall. What is the difference in their heights?

14. Mary sells 10 gal. of lemonade in glasses holding ½ pt. each, at 2 ¢ a glass. How much does she get for it?

15. How many badges 4 in. in length can be made from 16 yd. 8 in. of ribbon?

16. John takes 2 ft. and 2 in. at a step. How many steps does he take in going to school, if he lives 286 rd. from the schoolhouse?

17. How many feet of wire are there in a fence around a field 40 rd. 10 ft. wide and 130 rd. 12 ft. long?

18. John's bicycle goes 7 ft. 4 in. in making one turn of the wheel. How many turns of the wheel does it make in traveling 1½ miles?

19. What is the length of the four walls of a storeroom 6 ft. 6 in. × 7 ft. 6 in.?

20. Mrs. Johnston pays 45 ¢ a hundred pounds for ice, but by paying in advance she gets 1500 lb. for $5. How much does she save by paying in advance in a summer season when she uses in all 1½ T. of ice?

21. How many boxes, each holding 1 qt., can be filled from 3 bu. 1 pk. 7 qt. of blackberries?

22. How many feet does a mail carrier travel in delivering mail on a route of 21 mi. 176 rd. and returning?

MEASURES OF SURFACE

Observe that the straight lines AB and CD cannot meet, however far they may be extended. Such lines are called **parallel lines.**

A ━━━━━━ B
C ━━━━━━ D

The difference in direction of two lines meeting in a point is called an **angle.**

Lines that meet, making a square corner, form a **right angle.**

1. Point out several parallel lines in articles in the class-room; several right angles.

A figure that has four straight sides and four right angles is called a **rectangle.**

A rectangle having its four sides equal is called a **square.**

RECTANGLE

Rectangles that are not squares are called **oblongs.**

The number of square units that a surface contains is called its **area.**

How to find the area of a rectangle.

Find the area of a rectangle 4 yd. long and 3 yd. wide. How long is this rectangle? how wide? What is the *unit* of measure? How many such units are in the first row along the length? in the three rows, or the entire surface?

$3 \times 4 \times 1$ *sq. yd.* = ?

4 yd.

3 yd.

If the length and the width of a rectangle are expressed in inches, the unit of measure is 1 *sq. in.*; if expressed in feet, the unit of measure is 1 *sq. ft.*; if expressed in yards, the unit of measure is 1 *sq. yd.*; if expressed in rods, the unit of measure is 1 *sq. rd.* If the length and the width are expressed in related units, as feet and inches, or yards, feet, etc., the dimensions must be changed to like units before you find the area.

Written Work

1. Find the area of the floor of a room 26 ft. wide and 45 ft. long.

SOLUTION. $26 \times 45 \times 1$ *sq. ft.* = 1170 sq. ft.

NOTE. When the pupil has a thorough grasp of the subject, the solution may be abbreviated thus: 26×45 *sq. ft.* = 1170 sq. ft.

2. Find the area of a flower bed 10 ft. 6 in. in width by 20 ft. 8 in. in length.

SOLUTION. $10\frac{1}{2}$ ft., width ; $20\frac{2}{3}$ ft., length.
                    $10\frac{1}{2} \times 20\frac{2}{3}$ *sq. ft.*, or
                    $\frac{21}{2} \times \frac{62}{3}$ *sq. ft.* = 217 sq. ft.

The area of a rectangle is found by multiplying the unit of measure by the product of its two dimensions.

Draw on a suitable scale and find the surfaces of the following :

NOTE. The sign ′ represents feet and the sign ″, inches.

3. A rug $9' \times 12'$ **9.** A show window $16' \times 20'$

4. A window $4' \times 8'$ **10.** A mat $8'' \times 12''$

5. A room $10' \times 12'$ **11.** A 12-inch square

6. A door $3\frac{1}{2}' \times 8'$ **12.** An 8-inch square

7. A wall $12' \times 20'$ **13.** A 16-inch square

8. A hall $9' \times 16'$ **14.** A page $3\frac{1}{2}'' \times 6''$

Find the areas of the following rectangles :

15. 12 ft. by 20.5 ft.   **19.** 54 ft. by 115 ft.

16. 6.9 ft. by 21 ft.   **20.** 7 ft. by 45 yd.

17. $40\frac{1}{2}$ yd. by 72 yd.   **21.** 3 ft. by 108 in.

18. 3 yd. $2\frac{1}{2}$ ft. by 6 yd. 1 ft.   **22.** 108 in. by 54 ft.

23. Show by a diagram, on a scale of 1 inch to $\frac{1}{12}$ of an inch, the number of square inches in a square foot. (12×12 sq. in. = ? sq. in.)

24. Show by a diagram, on a scale of 1 yard to $\frac{1}{2}$ inch, the number of square feet in a square yard. (3×3 sq. ft. $= ?$ sq. ft.)

Find the area and the perimeter of the following. Draw rectangles to represent them on a scale of 1 yard to 1 inch:

25. A schoolroom 8 yd. wide and 10 yd. long.

26. A sidewalk 2 yd. wide and 12 yd. long.

27. Matting for a room 4 yd. wide and 5 yd. long.

28. Measure the length and the width of your schoolroom floor, and find the number of square feet it contains. Find the number of square feet in one of the blackboards.

29. Find the number of square feet of window light in your schoolroom.

30. Find the number of square inches in the surface of your desk; of your teacher's desk; of your different books.

31. Measure off on your school grounds or on some vacant lot a square rod. How many square feet should this contain? How many feet long should it be on each side? Observe that all these units of measure are squares. An acre contains 160 sq. rd., but it need not be a square.

Land is measured in *acres*, *square rods*, *square feet*, or in acres and parts of an acre.
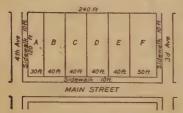
TABLE

144 square inches (sq. in.)	= **1** square foot (sq. ft.)
9 square feet	= **1** square yard (sq. yd.)
30$\frac{1}{4}$ square yards	= **1** square rod (sq. rd.)
160 square rods	= **1** acre (A.)
640 acres	= **1** square mile (sq. mi.)
1 A. = **160** sq. rd. = **4840** sq. yd. = **43,560** sq. ft.	

Written Work

Change:

1. 2700 sq. yd. to sq. ft.
2. 50 sq. ft. to sq. in.
3. 1600 sq. rd. to A.
4. $1\frac{5}{8}$ A. to sq. rd.
5. 800 sq. yd. to sq. rd.
6. $5\frac{3}{4}$ A. to sq. ft.

7. A farm is 60 rd. wide and 90 rd. long. Find the number of acres in it. Find its cost at $60 per acre.

8. A house 36 ft. by 42 ft. is built on a lot 100 ft. square. How much space is there for the lawn?

9. A concrete sidewalk in front of the lot is 4 ft. wide. Find its cost at 25 ¢ a square foot.

10. Find the cost of a flagstone walk, 6 ft. wide and 135 ft. long, at 21 ¢ a square foot.

11. There are 10 lots on Grant Street, each 40 ft. front and 120 ft. in depth. Draw a plan to show these lots, on a scale of 20 ft. to 1 in., and find the area of each lot.

12. Lots near the center of large cities are often sold by the front foot. Find the value of a lot on Central Street, 25 ft. front by 100 ft. deep at $50 a front foot.

13. Mr. Stokes, a real estate agent, purchases the lots shown in this plan, at $70 a front foot on Main Street. Find the cost of the lots.

14. Mr. Rand buys lot A at $110 a front foot, and builds on it a house for $6450. Find the cost of his property.

15. Mr. Taft buys lots B and C, and puts an iron fence around them at $1.10 a foot. Find the cost of the fence.

16. The sidewalk on Main Street is 10 ft. in width. Find the cost of Mr. Taft's walk at 29 ¢ a square foot.

17. Mr. Stokes sells lots D, E, and F to L. F. Porter for $9500. Find his profit on these lots.

18. At $1.10 a foot how much does Mr. Porter pay for an iron fence surrounding his lots?

19. A garden is 50 ft. by 73 ft. How many square feet does it contain?

20. The page of a book is 5 in. by $7\frac{1}{4}$ in. How many square inches are there on the page?

21. At $1.20 a square yard, how much does it cost to cover a floor 12 ft. by 15 ft. with linoleum?

22. A plate glass window is 9 ft. 8 in. wide and 12 ft. 3 in. long. How much does the window cost at $.36 a square foot?

23. A square ball park 600 ft. on a side is inclosed by a tight board fence 9 ft. in height. Find the outside surface of the fence in square yards.

24. A farm 120 rd. wide and 160 rd. long is sold in two pieces, $\frac{3}{8}$ of it at $60 an acre, and the remainder at $50 an acre. Find the amount of the entire sale.

25. An Indiana farmer owns a farm a mile square. How many acres has he? Find its value at $85 an acre.

26. A western wheat field 80 rd. wide and 100 rd. long yields 880 bu. of wheat. Find the average yield per acre.

27. Find the cost, at $100 a front foot, of a lot 30 ft. front by 100 ft. deep. Find the cost at $1 a square foot.

28. A four-room school building has a slate blackboard 4 ft. by 24 ft. in each room. Find the total cost of the blackboards at 33¢ a square foot.

29. The area of a field in the form of a rectangle is 8 A. If one side is 32 rd., what is the other side?

THE RIGHT TRIANGLE

Oral and Written Work

1. Draw on the blackboard a rectangle **12 in. by 8 in.** Connect the opposite corners by a straight line.

This line is called the **diagonal** of the rectangle. It divides the rectangle into two triangles.

A surface bounded by three straight lines is called a **triangle.** A triangle having one right angle is called a **right triangle.**

The side on which a triangle is assumed to stand is called the **base.**

The line that meets the base line at a right angle is called the **altitude.**

2. Point out the base and the altitude in the triangle at the left.

3. Fold a rectangular piece of paper, as *ABCD*, on its diagonal. Observe:

(1) That the rectangle *ABCD* and the triangle *ABD* have the same base and altitude.

(2) That the area of the triangle is just $\frac{1}{2}$ the area of the rectangle.

Hence the number of square inches in the area is $\frac{1}{2}$ of 4×2 or 4.

The area of a right triangle equals the unit of measure multiplied by $\frac{1}{2}$ the product of the base and the altitude.

Draw on a suitable scale and find the area of the following right triangles:

4. Base 10 in., altitude 8 in. **6.** Base 25 in., altitude 18 in.

5. Base 12 in., altitude 6 in. **7.** Base 36 in., altitude 24 in.

8. Base 16 ft., altitude 12 ft. **10.** Base 18 ft., altitude 14 ft.
9. Base 20 ft., altitude 16 ft. **11.** Base 24 ft., altitude 18 ft.

12. Observe the dimensions of this building. What are the heights of the sides of the building?

13. Find the number of square feet of siding needed for the sides and the two ends of the same height as the sides, making no allowance for openings.

14. The triangular parts at the top of the house, in front and in back, are called gables. Each gable can be divided by a line through the center of its base into two right triangles. How many square feet of siding are necessary for the two gables?
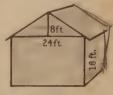
15. Find the cost of painting the siding on the house, at 15¢ a square yard.

16. John has a tent with dimensions as shown in the above illustration. Find the area of each end of the tent, and of each side of the tent.

17. Find the entire surface of the gable and the end of the house represented in this picture.
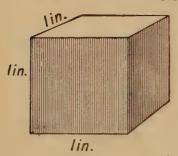
18. Find the cost of sodding the part of the school yard in front of your school at 10¢ a square foot.

** — 14

MEASURES OF VOLUME

Oral Work

1. How many dimensions has this figure? how many sides or faces? Show that each side is a square.

A solid with six equal square surfaces is called a **cube**.
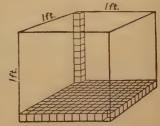
2. Look at the figure and tell how many edges it has. What is the length of each edge?

3. How many square inches are there in the base of a 1-inch cube?

A cube whose edge is 1 inch is called a **cubic inch**.

A solid bounded by six rectangular surfaces is called a **rectangular solid**.

4. Draw on paper or on the blackboard a square foot.

5. Divide each side into 12 equal parts and connect them by straight lines.

6. How many square inches equal a square foot?

7. 144 cubes 1 inch on an edge can be placed on a surface of 1 square foot, thus:

8. What is the height of 12 such layers of cubes? How many cubic inches are there in the first layer? in 12 layers?

9. How many cubic inches can be placed in the cube?

Observe in the figure on p. 211:

(1) That the first layer of units of volume contains 9 cubic inches.
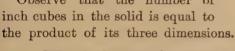
(2) That the whole solid, if 6 inches high, contains 6 × 9 cubic inches, or 54 cubic inches.

10. How many 1-inch cubes are there in the first layer? how many in the solid?

11. What is the shape of the surfaces of the solid?

A solid whose surfaces are all rectangles is called a **rectangular solid.**

Observe that the number of inch cubes in the solid is equal to the product of its three dimensions.

12. What is the unit of measure in this solid?

Observe that the number of cubic inches = 3 × 3 × 6, or 54.

The contents, or volume, of a rectangular solid is found by multiplying the unit of measure by the product of its three dimensions, when expressed in like units.

13. How many cubic feet are there in a cube 3 feet or 1 yard on an edge?

14. How many cubic inches are there in a cube 12 inche or 1 foot on an edge?

TABLE

1728 cubic inches (cu. in.)	= **1** cubic foot (cu. ft.)
27 cu. ft.	= **1** cubic yard (cu. yd.)
1 wagon load of earth	= **1** cu. yd.

Written Work

1. A schoolroom is 30 ft. wide, 40 ft. long, and 16 ft. high. Find the number of cubic feet of air in it.

2. Find the number of cubic yards of air in the room.

3. A piece of timber is 1 ft. square at the end and 12 ft. long. How many cubic feet are there in it?

4. How many 1-inch cubes are necessary to make a rectangular solid 12 in. long, 8 in. wide, and 4 in. high?

5. A box is 4 ft. long, 2 ft. wide, and 2 ft. high. Find the number of square feet in its six surfaces.

6. Find the number of cubic inches in the box.

7. A bin for grain is 12 ft. long, 8 ft. wide, and 5 ft. deep. Find the number of cubic feet in it.

8. There are 2150.42 cu. in. in a bushel of wheat. Find the number of bushels of wheat the bin will hold.

9. A water tank is 8 ft. long, 4 ft. wide, and 3 ft. deep. If a cubic foot of water weighs $62\frac{1}{2}$ lb., find the weight of the water when the tank is full.

10. A stone wall is 40 ft. long, 4 ft. high, and 2 ft. thick. Find the number of cubic feet of stone in it.

11. Find the cost, at $1 a wagon load (1 cubic yard), of excavating the ground for a cellar 30 ft. in length, 20 ft. in width, and 4 ft. in depth.

12. A laborer digs a ditch, 100 ft. long, 18 in. wide, and $2\frac{1}{2}$ ft. deep. Find the number of wagon loads of earth removed, and the cost at 50 cents a load.

13. Find the number of cubic feet of air in a schoolroom that is 20 ft. wide, 30 ft. long, and 16 ft. high.

14. If there are 29 pupils besides the teacher in this room how many cubic feet of air are there for each person?

15. If the rainfall on a certain day is $2\frac{1}{4}$ inches, find the number of cubic inches that fall on a lot 25 feet wide and 100 feet long.

16. Find the number of gallons of rain that fall on the lot in Ex. 15.

17. Find the cost of digging a ditch, 60 rd. long, $3\frac{1}{2}$ ft. wide, and 6 ft. deep, at 60 ¢ a cubic yard.

TABLE
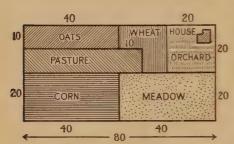
1 gallon = 231 cu. in.	1 T. coal = about 35 cu. ft.
1 bushel = 2150.42 cu. in.	1 T. hay = about 500 cu. ft.
1 bushel = about $1\frac{1}{4}$ cu. ft.	

18. Compare a 2-inch cube with a 4-inch cube. If a 2-inch cube weighs 6 ounces, how much does a 4-inch cube of the same material weigh ?

19. A bin is 8 ft. long, 6 ft. wide, and 4 ft. deep. Estimate quickly the number of bushels of wheat or oats that it will hold.

20. A farmer has a tank 12 ft. long, 8 ft. wide, and 6 ft. deep. How many gallons of water will it hold ?

21. Mr. Hoyt's coal bin is 12 ft. long, 8 ft. wide, and 5 ft. deep. Estimate quickly the number of tons of coal that it will hold.

22. A hay mow is 20 ft. wide, 50 ft. long, and 16 ft. deep. Estimate quickly the number of tons of hay in the mow.

23. A barrel holds 3 bu. How many cubic feet are there in such a barrel ?

24. Estimate quickly the number of bushels of grain in a wagon bin 4 ft. wide, $8\frac{1}{2}$ ft. long, and 2 ft. deep.

25. A cistern is 4 ft. long, 3 ft. wide, and 3 ft. deep. How many barrels of water will it hold ?

1. Mr. Franklin's farm is in the shape of the diagram The dimensions are given in rods. What is the size of the farm in acres? On what scale is the farm represented in the diagram?

2. Find by the scale the number of acres in oats; in corn; in pasture; in wheat.

3. The wheat yields 24 bushels to the acre and is sold for $2.00 a bushel. Find the value of the wheat crop.

4. The corn yields 85 bu. to the acre and is sold for $1.25 a bushel. Find the value of the corn crop.

5. How many tiles 12 in. square will be required to lay a floor 15 ft. by 36 ft.?

6. What is the length of a board walk that is 4 ft. 8 in. wide and contains 1350 sq. ft.?

7. If each of 2,000,000 American soldiers in France in 1918 received a Christmas box 9 in. long, 4 in. wide, and 8 in. high, how many cubic yards of space were needed to transport these boxes?

8. Find the number of square feet in a hall 45 ft. long and 30 ft. wide.

9. About how many bushels of wheat can be put into a bin 12½ ft. long, 10 ft. wide, and 10 ft. deep?

10. What is the number of gallons of water in a tank 12 ft. long, 10 ft. wide, and 8 ft. deep?

11. My farm is in the form of a rectangle, and contains 40 A. What is its width, if its length is 128 rd.?

12. What will be the cost of plastering the ceiling of a room 18 ft. by 22 ft., at 26 ¢ a square yard?

13. A rectangular field contains 5 A. If its length is 80 rd., what is its width?

14. How many cakes of soap 4 in. by 3 in. by 2 in. can be packed in a box whose inside dimensions are 4 ft. by 3 ft. by 2 ft.?

15. Find the cost of digging a cellar 42 ft. long, 30 ft. wide, and 6 ft. 3 in. deep, at 50 ¢ a cubic yard.

16. The width of a field is 30 rd., and its length is 80 rd. How many acres are there in the field?

17. What is the approximate number of bushels of wheat in a bin 20 ft. long, 16 ft. wide, and 8 ft. deep?

18. A tank 9 ft. square and 8 ft. deep contains how many gallons?

19. A building lot 100 ft. front contains 15,000 sq. ft. What is its depth?

20. A baseball ground 160 yd. by 170 yd. has a tight board fence around it 8 ft. high. How much will the painting of the outside of the fence cost at 22 ¢ a square yard?

21. The area of a right triangle is 560 sq. ft., and its altitude is 28 ft. What is the base of the triangle?

22. A plot of ground in the form of a square is 100 ft. on each side. A straight walk 8 ft. wide divides it into two equal parts — a lawn for flowers and a garden for vegetables. In the lawn there is a flower bed 5 ft. by 8 ft. Draw the plot.

23. Find the perimeter of the plot; of the lawn; of the garden; of the flower bed; of the walk.

Find the area in square yards:

24. Of the plot.   **26.** Of the flower bed.

25. Of the lawn.   **27.** Of the walk.

28. How much will it cost to fence the plot at $4¼ a rod?

29. How much will it cost to pave the walk at $1.55 a square yard?

30. How much will it cost to spade the flower bed at $.09 a square yard?

31. How much will it cost to sod the lawn, excluding the flower bed, at $.36 a square yard?

32. A room is 16 ft. wide, 20 ft. long, and 10 ft. high. How much will it cost to plaster the walls and the ceiling at $.30 a square yard?

33. How many gallons of water are there in a tank 12 ft. long, 8 ft. wide, and 6 ft. deep, if it is half full?

34. A city 5 mi. long and 3 mi. wide is equal in area to how many farms of 160 A. each?

35. How many sods 16 in. square will be required to turf a lawn 106 ft. 8 in. long and 50 ft. wide?

36. What will be the cost of painting the outside of a fence 10 ft. high around a lot 30 ft. wide, 48 ft. long, at $.37 a square yard?

37. Estimating that 300 cu. ft. of air are required for each person, how many persons should occupy a hall 40 ft. long, 30 ft. wide, and 12 ft. high?

38. Measure the length, the width, and the height of your schoolroom and estimate the number of cubic feet of air to each person in the room.

39. A street 40 ft. in width and 400 ft. in length is excavated to an average depth of 18 in. How many loads of earth must be removed, allowing 1 cu. yd. to the load?

PROBLEMS WITHOUT NUMBERS

1. How can two dissimilar decimals be made similar?

2. In multiplication of decimals, how many places must be pointed off in the result?

3. In division of decimals, how many places must be pointed off in the result?

4. How can you find the balance of a cash account when you have entered all the receipts and the payments?

5. You receive a bill for purchases, stating the quantity and the price of each. How can you tell whether the amount of the bill is correct?

6. Suppose that you wish to pay this bill by check. Explain how you would fill out the check.

7. How can you prove that you have paid a bill if payment is demanded a second time?

8. If you know the price of a gallon of molasses, how can you find the price of a quart?

9. If you know the price of a quart of vinegar, how can you find the price of a gallon?

10. From the price of a bushel of potatoes, how can you find the price of a peck? of a pound?

11. Knowing how many quarts of milk your family use in a day, tell how to find how many gallons they use in a week.

12. How can you change pounds to ounces? ounces to pounds? tons to pounds?

13. You know the length and the width of a rectangle. How do you find its area?

14. If you know one dimension and the area of a rectangle, how can you find the other dimension?

15. From the number of rods in the length and the width of a field, how can you tell the number of acres it covers?

TESTS FOR ACCURACY AND SPEED

NOTE. — In these exercises the pupils may occasionally "run num-ber races," to see how many correct answers each pupil can get in a given time. Establish a class standard and let each pupil drill until he has reached it.

Add and test:

1.	2.	3.	4.	5.	6.
45	48	458	$ 56.01	$ 50.01	$ 109.76
34	36	19	89.88	48.09	56.99
16	42	549	23.00	6.10	7.08
15	14	119	10.01	5.98	.89
18	12	45	8.08	.87	5.90
29	10	98	7.89	1.05	403.98
23	11	400	.98	.67	5.01

7.	8.	9.	10.	11.	12.
56	16	546	$ 51.33	$ 45.10	$ 190.01
78	27	890	9.10	8.10	490.00
91	83	78	14.09	4.19	28.98
10	26	980	.98	.98	.76
98	78	45	.48	.92	4.67
70	89	10	5.89	.87	.78
45	65	780	45.09	34.01	211.23
68	45	98	.87	9.11	.45

Subtract and test:

13.	400,566	16.	500,632	19.	$ 3009.85
	298,578		298,783		2783.72

14.	203,001	17.	300,102	20.	$ 1010.31
	19,785		198,456		983.67

15.	100,003	18.	109,203	21.	$ 9097.60
	99,998		56,789		7628.73

218

Multiply and test:

22. $21 \times \$25.75$	**46.** $11 \times \$480.48$
23. $62 \times \$5.92$	**47.** $29 \times \$300.63$
24. $99 \times \$2400$	**48.** $.002 \times \$850.50$
25. $101 \times \$1500$	**49.** $2.025 \times \$550$
26. $51 \times \$500$	**50.** $49 \times \$684.75$
27. $26 \times \$300$	**51.** $.25 \times \$400.20$
28. $54 \times \$5000$	**52.** 1.02×425.5
29. $109 \times \$200$	**53.** $37\frac{1}{2} \times \$240$
30. $26 \times \$50.25$	**54.** $.62\frac{1}{2} \times 96.60$
31. $25 \times \$25.50$	**55.** $.12\frac{1}{2} \times 880$
32. $11 \times \$9009$	**56.** $.16\frac{2}{3} \times 180$
33. $14 \times \$1008$	**57.** $.16\frac{2}{3} \times 6.12$
34. $53 \times \$75.50$	**58.** $.66\frac{2}{3} \times 66$
35. $21 \times \$50.25$	**59.** $.11\frac{1}{9} \times 87$
36. $99 \times \$581.50$	**60.** $.37\frac{1}{2} \times 40.72$
37. $.25 \times .22$	**61.** $.1232 \times .961$
38. $.17 \times .28$	**62.** $.2592 \times 8$
39. $.027 \times .03$	**63** $65.65 \times .65$
40. $27 \times .12$	**64.** 75.002×16.04
41. $.35 \times 42$	**65.** $275 \times .007$
42. 8.7×9.22	**66.** $.0018 \times 720$
43. $.085 \times 50$	**67.** $1500 \times .004$
44. $.027 \times 18$	**68.** $124 \times .064$
45. $1.005 \times .011$	**69.** $326 \times .096$

Find the totals of these bills:

70. $5\frac{1}{2}$ lb. butter @ \$.54
    $3\frac{1}{2}$ lb. flour @ \$.06
    $3\frac{1}{2}$ lb. sugar @ \$.10

71. $2\frac{3}{4}$ yd. silk @ \$1.76
    $3\frac{5}{8}$ yd. linen @ \$.56
    $4\frac{7}{8}$ yd. ribbon @ \$.24

Divide and test:

72. 47,084 by 607
73. 69,856 by 734
74. 37,809 by 640
75. 87,809 by 490
76. 74,633 by 487
77. 64,839 by 357
78. 56,783 by 678
79. 49,893 by 359
80. 34,843 by 598

81. 93,837 by 987
82. 60,895 by 786
83. 84,958 by 234
84. 99,363 by 945
85. 46,487 by 467
86. 79,849 by 945
87. 80,032 by 587
88. 21,389 by 903
89. 12,730 by 846

90. 464,341		a.	169
91. 846,760		b.	254
92. 864,548		c.	376
93. 645,341	by	d.	458
94. 624,872		e.	365
95. 784,100		f.	484
96. 810,404		g.	989
97. 904,025		h.	897

Form 8 groups of 8 ex-
amples each by dividing
each dividend by each divi-
sor, thus:

90 b.   464,341 ÷ 254 = ?

NOTE. The teacher will assign
a different group to each of 8 class
teams and will notice which team
makes the best record for speed
and accuracy.

98. $12 \div .12$
99. $10 \div .10$
100. $.8 \div .08$
101. $8 \div .008$
102. $.025 \div .5$
103. $900 \div .003$
104. $200 \div 2000$
105. $200 \div .002$
106. $2000 \div .02$

107. $.008 \div 800$
108. $25 \div 250$
109. $4.5 \div 1500$
110. $125 \div .25$
111. $7500 \div .125$
112. $950 \div 5000$
113. $7500 \div .0125$
114. $8600 \div .043$
115. $860 \div .0043$

116. $36.54 \div 42$

117. $.666 \div 74$

118. $6.675 \div 89$

119. $4.05 \div .27$

120. $.1705 \div .31$

121. $12.312 \div 27$

122. $2.25 \div 15$

123. $809.6 \div 16$

124. $256.25 \div 25$

125. $.5 \div .625$

126. $6.705 \div .009$

127. $139.195 \div 14.35$

128. $46.5 \div .1875$

129. $.00522 \div .29$

130. $.2375 \div .095$

131. $177.8028 \div 72.87$

132. $145.908 \div 1.26$

133. $.0656 \div .004$

Add:

134. $\frac{3}{4}, \frac{5}{8}, \frac{7}{16}$

135. $\frac{5}{12}, \frac{1}{2}, \frac{5}{6}$

136. $\frac{5}{16}, \frac{3}{4}, \frac{7}{8}$

137. $\frac{3}{5}, \frac{3}{20}, \frac{7}{10}$

138. $\frac{2}{3}, \frac{5}{9}, \frac{5}{18}$

139. $\frac{5}{12}, \frac{3}{24}, \frac{7}{24}$

140. $\frac{3}{4}, \frac{7}{12}, \frac{5}{12}$

141. $\frac{6}{7}, \frac{3}{7}, \frac{11}{21}$

142. $3\frac{2}{3}, 1\frac{5}{8}, \frac{11}{24}$

143. $4\frac{1}{2}, \frac{11}{16}, \frac{5}{8}$

144. $6\frac{2}{3}, \frac{5}{9}, 1\frac{11}{18}$

145. $3\frac{1}{3}, 4\frac{5}{8}, \frac{23}{24}$

Subtract:

146. $\frac{1}{3} - \frac{1}{8}$

147. $\frac{1}{5} - \frac{1}{6}$

148. $1\frac{1}{5} - \frac{1}{10}$

149. $\frac{1}{2} - \frac{1}{12}$

150. $\frac{5}{9} - \frac{1}{3}$

151. $\frac{7}{8} - \frac{3}{4}$

152. $4\frac{2}{5} - 2\frac{3}{8}$

153. $8\frac{3}{4} - 6\frac{3}{5}$

154. $5\frac{5}{6} - 3\frac{4}{5}$

Find the products:

155. $124\frac{3}{4} \times 3\frac{1}{2}$

156. $150\frac{3}{4} \times 27\frac{3}{4}$

157. $19\frac{1}{2} \times 20\frac{2}{3}$

158. $19\frac{3}{8} \times 120\frac{4}{5}$

159. 75.9×50.9

160. $200\frac{1}{2} \times 30\frac{1}{2}$

161. $29\frac{7}{12} \times 9\frac{1}{2}$

162. $95\frac{1}{2} \times 15\frac{3}{4}$

163. $24\frac{3}{4} \times 27\frac{1}{2}$

164. $38\frac{3}{8} \times 22\frac{1}{2}$

165. $25\frac{3}{4} \times 27\frac{1}{2}$

166. $16\frac{1}{4} \times 23\frac{1}{2}$

Find the quotients:

167. $3 \div \frac{1}{6}$

168. $4 \div \frac{1}{4}$

169. $5 \div \frac{1}{7}$

170. $6 \div \frac{1}{8}$

171. $8 \div \frac{1}{3}$

172. $15 \div \frac{3}{8}$

173. $16 \div \frac{4}{5}$

174. $\frac{3}{4} \div \frac{2}{3}$

175. $\frac{7}{8} \div \frac{4}{5}$

176. $\frac{5}{8} \div \frac{3}{5}$

177. $\frac{11}{12} \div \frac{4}{5}$

178. $\frac{5}{8} \div \frac{5}{6}$

179. $\frac{7}{8} \div \frac{7}{16}$

180. $\frac{7}{8} \div \frac{7}{10}$

181. $\frac{5}{6} \div \frac{5}{16}$

Find the quotients:

182. $12 \div 2\frac{1}{5}$ **188.** $145\frac{1}{2} \div 8$ **194.** $3648 \div 40\frac{5}{8}$

183. $15 \div 3\frac{3}{4}$ **189.** $160\frac{2}{3} \div 6$ **195.** $3648 \div 34\frac{5}{8}$

184. $18\frac{2}{3} \div 4$ **190.** $3245 \div 26\frac{2}{3}$ **196.** $4648 \div 12\frac{3}{16}$

185. $15\frac{3}{8} \div 5$ **191.** $2568 \div 32\frac{1}{2}$ **197.** $7894 \div 10\frac{3}{10}$

186. $180\frac{2}{3} \div 7$ **192.** $4531 \div 40\frac{2}{5}$ **198.** $3748 \div 15\frac{3}{5}$

187. $250\frac{3}{5} \div 9$ **193.** $4651 \div 27\frac{3}{4}$ **199.** $8976 \div 48\frac{5}{12}$

Change to decimals and test:

200. $\frac{5}{8}$ **203.** $\frac{5}{12}$ **206.** $\frac{7}{8}$ **209.** $\frac{9}{16}$ **212.** $\frac{7}{16}$

201. $\frac{3}{5}$ **204.** $\frac{5}{16}$ **207.** $\frac{11}{25}$ **210.** $\frac{19}{32}$ **213.** $\frac{17}{25}$

202. $\frac{2}{3}$ **205.** $\frac{5}{6}$ **208.** $\frac{3}{20}$ **211.** $\frac{7}{20}$ **214.** $\frac{7}{12}$

Change to decimals of not more than four places:

215. $\frac{7}{11}$ **219.** $\frac{17}{27}$ **223.** $\frac{35}{27}$ **227.** $\frac{1}{60}$

216. $\frac{9}{31}$ **220.** $\frac{9}{19}$ **224.** $\frac{37}{49}$ **228.** $\frac{6}{13}$

217. $\frac{45}{73}$ **221.** $\frac{11}{7}$ **225.** $\frac{7}{13}$ **229.** $\frac{27}{17}$

218. $\frac{29}{58}$ **222.** $\frac{25}{17}$ **226.** $\frac{5}{11}$ **230.** $\frac{13}{24}$

Change to common fractions:

231. .5   **240.** .375   **249.** .55   **258.** .45

232 .25   **241.** .875   **250.** .28   **259.** .38

233. .64   **242.** .625   **251.** .68   **260.** .54

234. $.33\frac{1}{3}$ **243.** .22   **252.** .44   **261.** .65

235. .95   **244.** .35   **253.** .32   **262.** .85

236. .52   **245.** .46   **254.** .58   **263.** .96

237. $.83\frac{1}{3}$ **246.** .750   **255.** .72   **264.** .24

238. $.66\frac{2}{3}$ **247.** .15   **256.** .92   **265.** .48

239. .84   **248.** .125   **257.** .36   **266.** .62

CHAPTER IV

UNITED STATES POSTAL RATES

First-class mail includes letters, U. S. postal cards, private post cards, and all sealed matter. The rate of postage on first-class mail is 2 ¢ an ounce or fraction thereof ; except that U. S. postal cards cost only 1 ¢.

Second-class mail includes newspapers and magazines not weighing over 8 oz. When sent by others than the publisher or news agent, the rate of postage on second-class mail is 2 ¢ for each 2 oz. or fraction thereof.

Third-class mail includes books, circulars, proof sheets, farm and factory products, and other merchandise not weighing over 8 oz.

(*a*) For third-class books, catalogues of over 24 pp., seeds, bulbs, etc. the rate is 1 ¢ for each 2 oz. or fraction thereof.

(*b*) For proof sheets and other third-class merchandise the rate is 1½ ¢ for each 2 oz. or fraction thereof.

Registration of domestic first-class mail costs 15 ¢ for values not exceeding $50 and 20 ¢ for values over $50 to $100.

Registration of domestic second-class mail without specified value costs 15 ¢.

Registration of domestic third-class mail costs 15 ¢ for values not exceeding $25.

1. Find the cost of mailing 5 letters, each weighing 1 oz.

2. Ida mails first class and registers a package valued at $65 weighing 12 oz. Find the postage required.

3. John mails a newspaper (second class) weighing 8 oz. and a first-class package weighing 19 oz. Find the postage.

4. Mary mails a box of handkerchiefs (third class) weighing 6 oz. Find the postage required.

5. How much does it cost to mail by registered third-class mail a box of neckties weighing 8 oz., valued at $5?

6. A printer mails a package of proofs (third class) weighing $6\frac{1}{2}$ oz. Find the postage required.

7. Paul mails a book (third class) weighing 8 oz. Find the cost, including 15 ¢ for registration.

8. A dealer sent out a 30-page catalogue weighing $7\frac{3}{4}$ oz. What was the cost of the postage?

9. Martha mails 15 letters (first class) weighing $\frac{3}{4}$ oz. each, 3 newspapers (second class) weighing respectively 6 oz., 7 oz., and 4 oz., and a sealed package (first class) weighing 12 oz. Find the cost of the postage.

UNITED STATES PARCEL POST RATES

Fourth-class mail matter includes all matter weighing over 8 oz. not now embraced by law in the first three classes.

The limit of weight for local delivery and for delivery within the *first three zones* is 70 pounds; in *other zones* it is 50 pounds.

Rates of postage on domestic parcel post matter for each pound or fraction of a pound are shown in the following table. These rates include a *service charge* of 2¢ for each parcel.

Weights	1st zone		2d zone, 50 to 150 miles	3d zone, 150 to 300 miles	4th zone, 300 to 600 miles	5th zone, 600 to 1000 miles	6th zone, 1000 to 1400 miles	7th zone, 1400 to 1800 miles	8th zone, all over 1800 miles
	Local Rate	Zone rate, 50 miles							
1 pound	$0.07	$0.07	$0.07	$0.08	$0.09	$0.10	$0.11	$0.13	$0.14
2 pounds	.08	.08	.08	.10	.13	.16	.19	.23	.26
3 pounds	.08	.09	.09	.12	.17	.22	.27	.33	.38
4 pounds	.09	.10	.10	.14	.21	.28	.35	.43	.50
5 pounds	.09	.11	.11	.16	.25	.34	.43	.53	.62
6 pounds	.10	.12	.12	.18	.29	.40	.51	.63	.74
7 pounds	.10	.13	.13	.20	.33	.46	.59	.73	.86
8 pounds	.11	.14	.14	.22	.37	.52	.67	.83	.98
9 pounds	.11	.15	.15	.24	.41	.58	.75	.93	1.10
10 pounds	.12	.16	.16	.26	.45	.64	.83	1.03	1.22
11 pounds	.12	.17	.17	.28	.49	.70	.91	1.13	1.34

Parcels may be *insured* up to $5 for 5 ¢; up to $25 for 8 ¢; up to $50 for 10 ¢; and up to $100 for 25 ¢. The service on parcels may be speeded up by affixing a 25-cent stamp for *special handling* in addition to the fourth-class rate and the 2-cent service charge.

NOTE. The local rate applies to parcels to be delivered at the office where mailed or on a rural route starting therefrom.

For packages weighing more than 11 lb. use the following table:

Local rate. — 7¢ for the first pound and 1¢ for each additional 2 pounds.

Zone	1st pound	Each extra pound	Zone	1st pound	Each extra pound
1st	$.07	$.01	5th	$.10	$.06
2d	.07	.01	6th	.11	.08
3d	.08	.02	7th	.13	.10
4th	.09	.04	8th	.14	.12

Find the cost of mailing each parcel:

	WEIGHT	MILES		WEIGHT	MILES
1.	10 oz.	500	8.	12 oz.	950
2.	1 lb. 5 oz.	140	9.	1 lb. 1 oz.	275
3.	8 lb. 2 oz.	45	10.	4½ lb.	575
4.	7¾ lb.	750	11.	15 oz.	Local
5.	9 oz.	200	12.	8 lb. 5 oz.	175
6.	1 lb. 11 oz.	750	13.	10 lb.	450
7.	11 lb.	900	14.	11 lb.	990

15. May sends an 8-pound turkey 75 miles. Find the cost of mailing it by parcel post marked "Special Handling."

16. A store sends out by parcel post a 6¾-lb. package to Mrs. Johnson 25 miles distant. Find the cost of mailing it.

17. Find the cost of mailing by parcel post for a distance of 950 miles a package of garden seed weighing 3 lb. 10 oz.

18. A girl in Lancaster, Pa., receives by parcel post a package from San Francisco (8th zone) weighing 9 lb. Find the cost of mailing it.

19. Find the cost of mailing a 10-pound package of chestnuts sent 75 miles by parcel post.

20. An umbrella valued at $10 and weighing 15 oz. is sent 70 miles. Find the cost of mailing and insuring it.

** — 15

FRACTIONAL RELATIONS

A fraction that has a fraction or a mixed number in **either or both of its terms** is called a **complex fraction.** A **complex fraction is** simply an indicated division of fractions.

$$\frac{2\frac{1}{4}}{\frac{5}{6}} = \frac{9}{4} \div \frac{5}{6} = \frac{9}{\underset{2}{\cancel{4}}} \times \frac{\overset{3}{\cancel{6}}}{5} = \frac{27}{10} = 2\frac{7}{10}$$

Find the value of :

1. $\dfrac{\frac{3}{4}}{\frac{5}{6}}$ **2.** $\dfrac{\frac{3}{4}}{\frac{3}{5}}$ **3.** $\dfrac{3\frac{1}{2}}{2\frac{1}{3}}$ **4.** $\dfrac{24}{\frac{5}{16}}$

How to find what part one number is of another.

Oral Work

1. What part of 6 is 3 ? $\frac{3}{6} = \frac{1}{2}.$

2. 3 is what part of 15 ? $\frac{3}{15} = \frac{1}{5}.$

3. What part of $\frac{3}{5}$ is $\frac{2}{5}$? $\dfrac{\frac{2}{5}}{\frac{3}{5}} = \frac{2}{5} \div \frac{3}{5} = \frac{2}{\cancel{5}} \times \frac{\cancel{5}}{3} = \frac{2}{3}.$

4. What part of $\frac{5}{8}$ is $\frac{3}{8}$? $\dfrac{\frac{3}{8}}{\frac{5}{8}} = \frac{3}{8} \div \frac{5}{8} = \frac{3}{\cancel{8}} \times \frac{\cancel{8}}{5} = \frac{3}{5}.$

Notice in each case that the number immediately **following** "what part of" is the denominator and the other **num-ber** the numerator of the fraction formed.

What part of :

5. 8 is 2 ?   **11.** 5 is 2 ?   **17.** $\frac{1}{2}$ is $\frac{1}{4}$?

6. 6 is 4 ?   **12.** 4 is 3 ?   **18.** $\frac{1}{4}$ is $\frac{1}{8}$?

7. 15 is 5 ?   **13.** 6 is 5 ?   **19.** $\frac{3}{5}$ is $\frac{2}{5}$?

8. 40 is 10 ?   **14.** 8 is 7 ?   **20.** $\frac{4}{5}$ is $\frac{3}{5}$?

9. 80 is 8 ?   **15.** 10 is 9 ?   **21.** $\frac{3}{4}$ is $\frac{3}{16}$?

10. 48 is 6 ?   **16.** 12 is 5 ?   **22.** $\frac{7}{8}$ is $\frac{5}{8}$?

Written Work

1. What part of 108 is 48?

$$\frac{48}{108} = \frac{4}{9}$$

Make the number 108 the denominator and the other number the numerator of a fraction, $\frac{48}{108}$, and reduce this to $\frac{4}{9}$.

2. What part of $4\frac{1}{2}$ is $\frac{3}{4}$?

$$4\frac{1}{2} = \frac{9}{2}, \quad \frac{\frac{3}{4}}{\frac{9}{2}} = \frac{3}{4} \div \frac{9}{2} = \frac{\overset{1}{\cancel{3}}}{\cancel{4}} \times \frac{\overset{1}{\cancel{2}}}{\cancel{9}} = \frac{1}{6}$$

Reduce the mixed number to the improper fraction $\frac{9}{2}$. Make $\frac{9}{2}$ the denominator and $\frac{3}{4}$ the numerator. Then divide $\frac{3}{4}$ by $\frac{9}{2}$. The result is $\frac{1}{6}$.

What part of :

3. 48 is 36?

4. 96 is 16?

5. 128 is 32?

6. 144 is 128?

7. $\frac{4}{5}$ is $\frac{3}{10}$?

8. $\frac{3}{4}$ is $\frac{3}{8}$?

9. 5 is $2\frac{1}{2}$?

10. $2\frac{1}{2}$ is $1\frac{1}{4}$?

11. $1\frac{1}{2}$ is $\frac{1}{2}$?

12. Stockings are marked down from 75 ¢ a pair to 50 ¢ a pair. What is the amount of reduction? What part of the first price is this reduction?

13. Rugs are reduced from $15 to $12. What part of the first price is the reduction?

14. During a season the American League played 150 games and won 75 games. What part of the games played did they win?

15. 1 cup of wheat flour weighs 4 oz.; 1 cup of barley flour weighs $2\frac{2}{3}$ oz.; 1 cup of rice flour weighs $4\frac{2}{3}$ oz. What part of a cup of wheat flour does a cup of barley flour weigh? a cup of rice flour?

16. John has 60 cents and pays 50 cents for a book. What part of his money does he pay out?

17. A grocer buys lemons for 40 ¢ a dozen and sells them for 50 ¢ a dozen. What part of the cost does he gain?

18. At a sale, shoes are reduced from $8 to $5 a pair. What part of the first price is the reduction?

19. What part of a yard of ribbon do I buy when I buy 18 inches?

20. John and Henry together receive 80 ¢ for a piece of work at which John works 2 hr. and Henry 3 hr. How should they divide the amount received?

> SOLUTION. Together they work 5 hr.
> John works 2 hr. and earns $\frac{2}{5}$ of the whole amount.
> Henry works 3 hr. and earns $\frac{3}{5}$ of the whole amount.
> $\frac{1}{5}$ of the whole amount = 16 ¢.
> $\frac{2}{5}$ of the whole amount = 2 × 16 ¢, or 32 ¢, John's earnings.
> $\frac{3}{5}$ of the whole amount = 3 × 16 ¢, or 48 ¢, Henry's earnings.

21. Mary and Lucy together pick 49 qt. of strawberries. Mary picks 4 qt. as often as Lucy picks 3 qt. How should they divide the berries?

How to find a number when a fractional part of it is given.

Written Work

1. If $\frac{3}{4}$ of a number is 30, what is the number?

$$30 \div \frac{3}{4} = 3\cancel{0}^{10} \times \frac{4}{3} = 40$$

$\frac{3}{4}$ × the required number = 30. Hence 30 = the product of $\frac{3}{4}$ by the required number. Therefore the required number = 30 ÷ $\frac{3}{4}$, or 40.

2. 360 is $\frac{6}{25}$ of what number?

$$360 \div \frac{6}{25} = 3\cancel{6}\cancel{0}^{60} \times \frac{25}{\cancel{6}} = 1500$$

Since $360 = \frac{6}{25} \times$ a number, the product 360 divided by the factor $\frac{6}{25} =$ the missing factor. $360 \div \frac{6}{25} = 1500$.

3. If $\frac{7}{8}$ is $\frac{3}{4}$ of a number, what is the number?

$$\frac{7}{8} \div \frac{3}{4} = \frac{7}{\cancel{8}_2} \times \frac{\cancel{4}}{3} = \frac{7}{6} = 1\frac{1}{6}$$

$\frac{7}{8} = \frac{3}{4} \times$ the number. Therefore the number = $\frac{7}{8} \div \frac{3}{4}$, or $1\frac{1}{6}$.

Find the number of which:

4. 84 is $\frac{7}{8}$	**7.** $12\frac{2}{3}$ is $\frac{19}{20}$	**10.** $\frac{11}{12}$ is $\frac{22}{25}$
5. 196 is $\frac{4}{11}$	**8.** $\frac{7}{9}$ is $\frac{7}{16}$	**11.** $5\frac{3}{6}$ is $\frac{11}{14}$
6. $3\frac{1}{2}$ is $\frac{7}{9}$	**9.** $1\frac{2}{13}$ is $\frac{6}{7}$	**12.** $3\frac{1}{2}$ is $\frac{7}{8}$
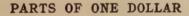
13. In the business where Mr. Hoyt worked, all the wages were increased $\frac{1}{5}$. He then earned $1800 a year. How much did he earn before the increase? (Suggestion. $1800 = \frac{6}{5} \times$?)

14. A rug was sold for $\frac{3}{4}$ of its original price. The bill for it was $150. What was the original price?

15. In an examination, John had $\frac{4}{5}$ of his spelling words correct. If he spelled 64 words right, how many words were given in the examination?

16. Mr. Gray set aside $\frac{3}{10}$ of his salary for food, and found that he had $600 to spend for this item. What was his salary?

17. Mr. Ford spent $\frac{2}{15}$ of his salary for clothing. His clothing bills amounted to $220. What was his salary?

PARTS OF ONE DOLLAR

Learn the following table of parts of $1:

$.02 $= \frac{1}{50}$ of $1.	$.16\frac{2}{3}$ $= \frac{1}{6}$ of $1.	$.60 $= \frac{3}{5}$ of $1.
$.04 $= \frac{1}{25}$ of $1.	$.20 $= \frac{1}{5}$ of $1.	$.62\frac{1}{2}$ $= \frac{5}{8}$ of $1.
$.05 $= \frac{1}{20}$ of $1.	$.25 $= \frac{1}{4}$ of $1.	$.66\frac{2}{3}$ $= \frac{2}{3}$ of $1.
$.06\frac{1}{4}$ $= \frac{1}{16}$ of $1.	$.33\frac{1}{3}$ $= \frac{1}{3}$ of $1.	$.75 $= \frac{3}{4}$ of $1.
$.08\frac{1}{3}$ $= \frac{1}{12}$ of $1.	$.37\frac{1}{2}$ $= \frac{3}{8}$ of $1.	$.80 $= \frac{4}{5}$ of $1.
$.10 $= \frac{1}{10}$ of $1.	$.40 $= \frac{2}{5}$ of $1.	$.83\frac{1}{3}$ $= \frac{5}{6}$ of $1.
$.12\frac{1}{2}$ $= \frac{1}{8}$ of $1.	$.50 $= \frac{1}{2}$ of $1.	$.87\frac{1}{2}$ $= \frac{7}{8}$ of $1.

Oral and Written Work

1. Find the cost of 12 yd. of gingham at $\$.16\frac{2}{3}$ a yard.

SOLUTION. $\$.16\frac{2}{3} = \$\frac{1}{6}$, cost of 1 yd.
  $12 \times \$\frac{1}{6} = \$\frac{12}{6}$, or $2, cost of 12 yd.

Find the cost of:

2. 8 yd. lace @ $\$.12\frac{1}{2}$

3. 12 yd. muslin @ $\$.16\frac{2}{3}$

4. 16 yd. lace @ $\$.06\frac{1}{4}$

5. 15 yd. muslin @ $\$.33\frac{1}{3}$

6. 18 lb. tea @ $\$.66\frac{2}{3}$

7. 24 lb. rice @ $\$.12\frac{1}{2}$

8. 90 boxes crackers @ $.10

9. 40 boxes crackers @ $.20

10. 80 lb. starch @ $.05

11. 60 lb. fish @ $.25

12. 40 cans corn @ $.10

13. 96 boxes berries @ $\$.12\frac{1}{4}$

14. 54 boxes berries @ $\$.16\frac{2}{3}$

15. 16 lb. steak @ $\$.37\frac{1}{2}$

16. 80 lb. sausage @ $.25

17. 50 yd. cloth @ $.75

18. 75 doz. eggs @ $.50

19. 40 yd. linen @ $\$.62\frac{1}{2}$

20. 150 lb. coffee @ $\$.33\frac{1}{3}$

21. 48 lb. prunes @ $\$.12\frac{1}{2}$

22. 60 lb. rice @ $\$.08\frac{1}{3}$

23. 15 lb. coffee @ $.25

24. How many yards of lace at $\$.06\frac{1}{4}$ a yard can be bought for $50?

SOLUTION. $\$.06\frac{1}{4} = \frac{1}{16}$ of $1. Hence 16 yd. can be bought for $1, and 50×16 yd., or 800 yd., can be bought for $50.

How many yards can be bought for:

25. $2 @ $.05

26. $5 @ $\$.62\frac{1}{2}$

27. $3 @ $\$.37\frac{1}{2}$

28. $16 @ $\$.06\frac{1}{4}$

29. $4 @ $\$.16\frac{2}{3}$

30. $7 @ $\$.87\frac{1}{2}$

31. $16 @ $.80

32. $25 @ $\$.12\frac{1}{2}$

33. $20 @ $.20

34. $50 @ $\$.83\frac{1}{3}$

35. $30 @ $\$.33\frac{1}{3}$

36. $24 @ $\$.08\frac{1}{3}$

37. $40 @ $.40

38. $20 @ $.50

39. $50 @ $.25

40. $36 @ $\$.37\frac{1}{2}$

41. $42 @ $\$.66\frac{2}{3}$

42. $32 @ $\$.06\frac{1}{4}$

Read and give approximate results; then solve, using the shortest methods of solution:

43. Father bought 75 cows at $87½ each, and sold them at $100 each. How much did he gain?

44. Margaret bought 15 lb. of tea at $.40 a pound, 16 lb. of rice at $.12½ a pound, and 16 lb. of sugar at $.06¼ a pound. How much change should she receive from $15?

45. From a piece of cloth containing 40 yd. three dress patterns of 12½ yd. each were sold. How much was the remainder worth at $1.25 a yard?

46. Mother bought 6 lb. of codfish at 2 lb. for $.25, 12 lb. of starch at 3 lb. for $.25, and 6 lb. of coffee at 3 lb. for $1. Find the amount of her bill and the change she received from $5.

47. Make and solve two problems involving multiplication by parts of a dollar, and two involving division by parts of a dollar.

EQUATIONS

A statement of equality between two equal quantities is called an **equation**; as, $5 \times 6 = 30$; 1 ft. 4 in. = 16 in.

A **parenthesis** ( ) is sometimes used to group expressions. Operations within a parenthesis must be performed first.

Thus, $4 + (7 \times 5) = 4 + 35 = 39$; while $(4 + 7) \times 5 = 11 \times 5 = 55$.

1. $(7 \times 5) + 6 = ?$

2. $7 \times (5 + 6) = ?$

3. $19 + 36 = 18 + ?$

4. $17 + ? = 56$

5. $(6 \times 8) + (4 \times 9) = ?$

6. $(15 \div 3) - (6 \div 2) = ?$

7. $5 \times 8 = 32 + ?$

8. $(48 \div 3) \times 6 = ?$

9. $(10 \times 6) \div (5 \times 3) = ?$

10. $(8 \times 9) \div (3 \times 4) = ?$

11. $(5 \times 7) \div (8 - 3) = ?$

12. $9 \times 7 = ? + 56$

13. $(16 \div 8) + 9 = 7 + ?$

14. $(24 \div 4) - 3 = 6 + ?$

I. Before you try to solve a problem you must find out exactly what it means. That is, you must consider:

a. What facts are stated or implied in the problem.

b. What kind of answer the question asks for.

c. By what steps the required answer can be found from the given facts.

II. The most important habit to acquire is **accuracy**. A wrong answer is worthless. Always test your work. Also make a **mental estimate** of the answer.

1. How much cheaper is it to buy a barrel of flour (196 lb.) for $12 than at 8 ¢ a pound?

John answered $144.80. He had pointed off wrong in multiplying. If he had first formed a mental estimate, he could not have made such a mistake. Thus, 196 lb. = nearly 200 lb. 200 × 8 ¢ = 1600 ¢ = $16. $16 − $12 = $4. The *exact answer* found by the written work is $3.68.

2. A man gave a check of $10,000 in payment of two bills of $4998 and $3993. How much change should he get?

Mental estimate: The bills amounted to about $5000 + $4000, or $9000; change, about $1000. The *exact answer* obtained by the written work is $1009.

Tell by **mental estimates** whether:

3. 20 × 23 is more or less than 46.

4. 7 × $25.65 is more or less than $140.

5. $500 ÷ 56 is more or less than $10.

6. $25.40 ÷ 8 is more or less than $.03.

7. $\frac{3}{4}$ of $2\frac{7}{8}$ is more or less than 3.

8. $1\frac{2}{3}$ × 7 is more or less than 7.

9. Find the cost of $3\frac{7}{8}$ yd. of ribbon at $.23 a yard.

Facts stated: Amount of ribbon bought; price per yard.

Question: What is the cost of the total amount bought?

Mental estimate: $3\frac{7}{8}$ yd. cost about 4 × $.23, or $.92.

Written work: $3\frac{7}{8} = \frac{31}{8}$; $\frac{31}{8}$ × $.23 = $.89$\frac{1}{8}$.

Test: 3 × $.23 = $.69; $\frac{7}{8}$ of $.23 = $.20$\frac{1}{8}$; $.69 + $.20$\frac{1}{8}$ = $.89$\frac{1}{8}$.

III. The second essential is **rapidity.** To secure **rapidity,** always choose the *shortest method* of work where several methods are possible. It is sometimes well to *indicate* the necessary operations before performing any of them. Then the work may often be shortened by *cancellation.*

10. If a man earns $ 18 in 6 days, how much, at the same rate, does he earn in 28 days ?

SOLUTION. $18 ÷ 6 = $3; 28 × $3 = $84.   This method is called **unitary analysis,** because the earning for the *unit, 1 day,* is first found.

11. If a man earns $ 18 in 6 days, how much, at the same rate, does he earn in 24 days ?

SOLUTION.   24 da. = 4 × 6 da.; 4 × $18 = $72.   This is called the **method of comparison,** because the answer is found by comparing 6 da. directly with 24 da.

12. If a man earns $18 in 6 days, how much, at the same rate, does he earn in 10 days?

(a) *Unitary analysis :* $18 ÷ 6 = $3; 10 × $3 = $30.

(b) *Comparison :* 10 da. = $\frac{10}{6}$ of 6 da.; $\frac{10}{6}$ × $18 = $30.

(c) *Cancellation :* $\dfrac{10 \times \overset{3}{\cancel{\$18}}}{\cancel{6}} = \$30.$

13. How many cubic yards of earth are removed in digging ditch 54 ft., long $3\frac{1}{2}$ ft. wide, and 2 ft. deep ?

SOLUTION. $\overset{2}{\cancel{54}} \times \dfrac{7}{\cancel{2}} \times \cancel{2} \times \dfrac{1}{\cancel{27}}.$ *Ans.* 14 cu. yd.

It is often convenient to indicate a solution in the form of an equation.   (See p. 231.)

14. A boy paid $1.40 a hundred for newspapers and sold them at $.02 apiece. How much did he gain (a) on 100 papers?   (b) on 1 paper?

SOLUTION.   (a) Gain on 100 papers = (100 × $.02) − $1.40 = $.60.

(b) Gain on 1 paper = $.60 ÷ 100 = $.006.

EVERYDAY USE OF NUMBERS

1. The cost of providing a 2 weeks' outing for 100 girl scouts was $650. Find the cost per week for each girl.

2. How much gasoline will be saved by driving 5400 miles in a car that averages 27 miles per gallon instead of in one that averages 18 miles per gallon?

3. During one week a department store sold 226,997 handkerchiefs at 25¢ each. Find the amount of these sales.

4. Find the value, at $4.18 each, of 13,799 umbrellas sold in the same week.

5. Make and solve a problem about the amount you save by buying three articles at a bargain sale.

6. A wage increase of $2,500,000 was granted to 15,000 street car employees. What was the average for each?

7. The pay of a conductor was increased from $.39 an hour to $.50 an hour. How much did the increase amount to in a week consisting of six 8-hour days?

8. Mrs. Hunt received $100 a month for household expenses. Her account one month showed that she spent $20 for rent, $27.50 for food, $9.50 for light, heat, and laundry, $16.50 for clothing, and $16.75 for other items. How much did she save that month?

9. It took 4000 hours of work to complete an airplane. How long did it take 80 men working 8 hours a day to do the work?

10. The distance covered by the air mail service in 78 hours was 5304 miles. What was the average speed per hour?

11. Make and solve a problem suggested by some game that you play.

The heat provided for our bodies by our food is measured in heat units. The following is part of a Bill of Fare:

	Price	Heat Units		Price	Heat Units
Bean soup	10¢	(300)	Omelette	20¢	(340)
Beefsteak	50¢	(530)	Ice cream	10¢	(200)
Beef cutlet	25¢	(390)	Stewed apricots	5¢	(140)
Mashed potatoes	10¢	(175)	Cup custard	10¢	(220)

12. Alice ordered beefsteak and apricots. Find the cost and the number of heat units.

13. Margaret ordered soup, potatoes, and custard. Find the cost and the number of heat units.

14. How much less did Margaret spend than Alice, and how many more heat units did her food provide?

Compare the following two meals as to cost and heat units:

15. Beef cutlet, potatoes, and ice cream.

16. Bean soup, omelette, and cup custard.

17. The receipts of a railway for 365 days were $119,685.23, and the expenses, $96,478.02. Find the average daily profits.

Note. Find averages to nearest cent, that is, call $.574, $.57; call $.575, and $.576, $.58; etc.

18. A ticket agent sold in one day: 450 tickets @ $1.50; 380 tickets @ $1.00; 520 tickets @ $.75; and 310 tickets @ $.50. Find the total amount of his sales.

19. Find the average amount of each subscription for each loan:

Liberty Loan	Subscribers	Amount	Averages
First 3½'s	4,000,000	$3,035,220,850	
Second 4's	9,400,000	4,617,532,200	
Third 4¼'s	18,398,325	4,176,516,750	
Fourth 4¼'s	21,800,000	6,866,416,300	

EVERYDAY USE OF NUMBERS

A Sewing Club

Our club is making dresses for poor children. We use gray outing flannel at 31¢ a yard. Find the cost of a dress of each of the following sizes:

SIZE

1. 1 yr. requires $1\frac{5}{8}$ yd.
2. 2 yr. requires $1\frac{3}{4}$ yd.
3. 4 yr. requires $1\frac{7}{8}$ yd.
4. 6 yr. requires $2\frac{3}{8}$ yd.
5. 7 yr. requires $2\frac{5}{8}$ yd.
6. 8 yr. requires $2\frac{7}{8}$ yd.
7. After 4 dresses of each size have been cut from a 60-yard piece, how much material is left?

8. How much more material is needed for the 8 yr. size than for the 2 yr. size?

9. How many of the 4 yr. size dresses can be cut from 30 yd. of the flannel? how many of the 7 yr. size?

10. How many of the 6 yr. size dresses can be cut from 38 yd. of the flannel?

11. If it takes 20 yd. of material 27 in. wide to make a dozen dresses, how many yards of material 36 in. wide does it take? (SUGGESTION. $\frac{27}{36}$ of 20 yd. = ?)

12. How much is saved on the 12 dresses in problem 11 by buying 36-inch flannel @ 36¢ instead of 27-inch flannel @ 31¢?

13. Margaret uses $1\frac{9}{16}$ yd. of flannel at 36¢ a yard for an infant's long wrapper. Find the cost.

14. Dorothy uses $5\frac{5}{8}$ yd. of flannel at 36¢ a yard for a pair of pajamas. How much do a dozen pairs cost?

A Knitting Club

1. Edith knitted a sweater. It took $2\frac{1}{2}$ hanks of yarn, and there were 4 hanks to the pound. What part of a pound did it take?

2. At $3 a pound, how much did Edith pay for the yarn for the sweater?

3. Edith knitted 4 rows of the sweater in 10 min. How many rows did she knit, at the same rate, in an hour?

4. Counting 6 rows to an inch, how long did it take Edith, at the same rate, to knit a sweater 23 in. long in front and 23 in. in back?

5. At a knitting contest Edith's cousin Dora finished a sweater between 1.15 P.M. and 7 P.M. How long did it take her?

6. How much less time did it take Dora than Edith?

7. If it required $2\frac{1}{2}$ hanks of wool to make a sweater 23 in. long in front and back, how much was needed to make one 25 in. long in front and back?

8. When yarn was sold at $3 a pound, what was the cost of a ball containing 9 oz.? (16 oz. = 1 lb.)

9. Clara knitted 3 rows of a sock in $5\frac{1}{2}$ min. How long, at the same rate, did it take her to knit 8 in., allowing 9 rows to an inch?

10. If it took Esther $2\frac{1}{2}$ hr. to knit 8 in. on a sock, how long, at the same rate, did it take her to knit 5 in.?

11. A ball of wool weighing $3\frac{3}{5}$ oz. cost $.90. What was the price per pound?

12. It took $\frac{5}{16}$ lb. of wool to make a pair of socks. How many pairs could be made from $2\frac{1}{2}$ lb. of wool?

PERCENTAGE

Oral and Written Work

You have learned (p. 175) that another name for *hundredths* is *per cent*.

Read the following problem, substituting "per cent" for "hundredths":

1. At a sale Martha bought an umbrella which was marked down 20 hundredths from the original price of $4.00. How much did Martha pay for the umbrella?

2. Write 20 hundredths as a decimal.

3. What is the sign for per cent? Write 20 per cent with this sign.
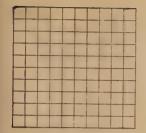
Write the following, using the sign % instead of the decimal form:

4. .03	**6.** .08	**8.** .17	**10.** .33	**12.** .80
5. .06	**7.** .10	**9.** .25	**11.** .50	**13.** 1.00
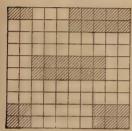
Write the following numbers as decimals:

14. 6 %	**16.** 12 %	**18.** 24 %	**20.** 52 %	**22.** 94 %
15. 9 %	**17.** 18 %	**19.** 30 %	**21.** 83 %	**23.** 89 %

Write the following fractions as decimals; as per cents:

24. $\frac{1}{2}$	**26.** $\frac{3}{4}$	**28.** $\frac{2}{5}$	**30.** $\frac{4}{5}$	**32.** $\frac{3}{20}$	**34.** $\frac{3}{25}$
25. $\frac{1}{4}$	**27.** $\frac{1}{5}$	**29.** $\frac{3}{5}$	**31.** $\frac{1}{10}$	**33.** $\frac{4}{25}$	**35.** $\frac{7}{25}$
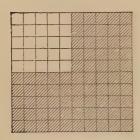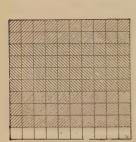
36. Cut out of a sheet of squared paper a large square containing **100** smaller squares as shown in the figure. Each small square is how many hundredths of the larger square? Each small square is how many per cent of the larger square?

37. What per cent of the large square is shaded in the upper left-hand corner of this figure? in the lower left-hand corner? in the center? in the upper right-hand corner? in the lower right-hand corner? What per cent of the square is left unshaded?

Mark off on squared **paper 10 large** squares each containing 100 smaller squares.

38. Shade 5 % of the first square.

39. Shade 8 % of the second square.

40. Shade 14 % of the third square.

41. Shade 20 % of the fourth square.

42. Shade 25 % of the fifth square.

43. Shade 50 % of the sixth square.

44. Shade 75 % of the seventh square.

45. Shade 60 % of the eighth square.

46. Shade 80 % of the ninth square.

47. Shade 100 % of the tenth square.

Fractional equivalents of per cents.

Oral Work

1. How many per cent of the first large square equal $\frac{1}{2}$ of it? $\frac{1}{4}$ of it? $\frac{3}{4}$ of it?

2. How many per cent of the second large square equal $\frac{1}{5}$ of it? $\frac{2}{5}$ of it? $\frac{3}{10}$ of it?

50 % of anything equals $\frac{1}{2}$ of it.
25 % of anything equals $\frac{1}{4}$ of it.
20 % of anything equals $\frac{1}{5}$ of it.

3. What fraction in its lowest terms is equivalent to 40%? to 60%? to 80%?

4. What fraction in its lowest terms is equivalent to 75%?

5. How much is $\frac{1}{8}$ of 100? Then $.12\frac{1}{2}$ = what fraction in its lowest terms? $12\frac{1}{2}\%$ = what fraction in its lowest terms?

6 How much is $\frac{1}{3}$ of 100? Then $33\frac{1}{3}\%$ = what fraction in its lowest terms?

7. What is $\frac{1}{6}$ of 100? Then $16\frac{2}{3}\%$ = what fraction?

8. $\frac{3}{8}$ of 100 = ? $37\frac{1}{2}\%$ = what fraction?

Memorize the following table :

$\frac{1}{2}=50\ \%$	$\frac{3}{4}=75\ \%$	$\frac{4}{5}=80\ \%$	$\frac{3}{8}=37\frac{1}{2}\ \%$
$\frac{1}{3}=33\frac{1}{3}\ \%$	$\frac{1}{5}=20\ \%$	$\frac{1}{6}=16\frac{2}{3}\ \%$	$\frac{5}{8}=62\frac{1}{2}\ \%$
$\frac{2}{3}=66\frac{2}{3}\ \%$	$\frac{2}{5}=40\ \%$	$\frac{5}{6}=83\frac{1}{3}\ \%$	$\frac{7}{8}=87\frac{1}{2}\ \%$
$\frac{1}{4}=25\ \%$	$\frac{3}{5}=60\ \%$	$\frac{1}{8}=12\frac{1}{2}\ \%$	$\frac{1}{12}=8\frac{1}{3}\ \%$

Express as decimals and as per cents :

9. $\frac{1}{3}$ **10.** $\frac{2}{3}$ **11.** $\frac{4}{3}$ **12.** $\frac{3}{8}$ **13.** $\frac{5}{8}$ **14.** $\frac{7}{8}$ **15.** $\frac{1}{6}$ **16.** $\frac{1}{12}$

Express the following as fractions in their lowest terms :

17. $66\frac{2}{3}\%$ **19.** $37\frac{1}{2}\%$ **21.** $33\frac{1}{3}\%$ **23.** $62\frac{1}{2}\%$

18. $12\frac{1}{2}\%$ **20.** $16\frac{2}{3}\%$ **22.** $87\frac{1}{2}\%$ **24.** $8\frac{1}{3}\%$

How to find a given per cent of a number.

Oral Work

1. 1% of $50 means $.01 \times \$50$, or \$——.

2. 2% of $50 means $.02 \times \$50$, or \$——.

3. 50% of $50 means $.50 \times \$50$, or \$——.

4. 100% of $50 means $1.00 \times \$50$, or \$——.

5. 150% of $50 means $1.50 \times \$50$, or \$——.

6. How much is 1% of \$60 ? 2% of \$45 ?

7. How much is 50% of \$80 ? 100% of \$10 ?

Find :

8. 2% of \$10

9. 3% of \$20

10. 5% of \$40

11. 6% of \$50

12. 7% of \$60

13. 8% of \$70

14. 9% of \$80

15. 10% of \$90

16. 12% of \$200

17. 15% of \$200

18. 50% of \$10

19. 25% of \$40

20. 75% of \$80

21. 60% of \$20

22. 40% of \$30

23. 80% of \$60

24. $12\frac{1}{2}\%$ of \$80

25. $37\frac{1}{2}\%$ of \$40

26. $87\frac{1}{2}\%$ of \$80

27. $62\frac{1}{2}\%$ of \$16

28. $16\frac{2}{3}\%$ of \$18

29. $33\frac{1}{3}\%$ of \$30

30. $66\frac{2}{3}\%$ of \$60

31. $8\frac{1}{3}\%$ of \$12

** — 16

32. In a spelling test of 100 words Arthur missed 6 %. How many words did he miss ?

33. On a stormy day 8 % of the pupils in a school containing 500 pupils were absent. How many pupils were absent ?

34. Jean's mark in arithmetic was 75 %. If the test consisted of 8 problems, how many did Jean have right ? (Remember that 75 % = $\frac{3}{4}$.)

35. One week Charles played 20 games of tennis and won 50 % of them. How many games did he win ?

36. A book priced at $3 was reduced to $33\frac{1}{3}$ % of this price. How much was it reduced ?

37. In September $16\frac{2}{3}$ % of the days were rainy. On how many days did it rain ?

38. Susan was absent 10 % of 180 days in the school year. How many days was she absent ?

Six teams in the Harmon Baseball League played 18 games each :

39. The first team won $66\frac{2}{3}$ % of the games they played. How many games did they win ?

40. The second team won 75 % of the games they played. How many games did they win ?

41. The third team lost 25 % of the games they played. How many games did they lose ?

42. The fourth team won $33\frac{1}{3}$ % of the games they played. How many games did they win ?

43. The fifth team lost 50 % of the games they played. How many games did they lose ?

44. The sixth team lost $16\frac{2}{3}$ % of the games they played. How many games did they lose ?

45. John earned $10 a month and put 20 % of it in the school savings bank. How much did he deposit ?

Written Work

1. A school team played 40 games of baseball and **won** 35 % of them. How many games were won ?

$$\begin{array}{r} 40 \\ .35 \\ \hline 2\,00 \\ 12\,0 \\ \hline 14.00 \end{array}$$ Per cent means *hundredths*; .35 of 40 games = 14 games.

2. Mr. Root earned $4000 a year. He spent 30 % for food. Find the cost of the food.

3. Mr. Root spent 22 % of his salary of $4000 for rent. How much did he spend for rent ?

4. If you had 85 % on a spelling test of 200 words, how many words were correct ?

5. A man's salary was increased 25 % from $1500. How much was the increase ?

6. How much did a man gain by buying a house **for** $2000 and selling it at a profit of 20 % ?

7. Arthur earned $80 a month and saved $12\frac{1}{2}$ % of it. How much did he save ?

8. A city having 12,000 inhabitants increased in population by 12 % in a year. What was the increase in population ?

9. The distance between two cities is 1200 miles. How many miles equal $37\frac{1}{2}$ % of this distance ?

10. In an orchard of 600 trees, $66\frac{2}{3}$ % were apple trees. How many apple trees were there ?

11. How many ounces are there in $37\frac{1}{2}$ % of a pound ?

12. How many inches are there in $16\frac{2}{3}$ % of a yard ?

NOTE. — In the applications of percentage involving money, results are found to the nearest cent; that is, less than $\frac{1}{2}$ cent in the final result is discarded and $\frac{1}{2}$ cent or a greater fraction of a cent is counted as an extra cent.

Find in the shortest way:

5 % of	10 % of	15 % of	20 % of
1. 685	5. $545.50	9. 256	13. $500.50
2. 606	6. $790.75	10. 349	14. $406.89
3. 750	7. $332.80	11. 874	15. $375.40
4. 438	8. $840.90	12. 207	16. $209.01

$62\frac{1}{2}$ % of	$66\frac{2}{3}$ % of	$16\frac{2}{3}$ % of	$87\frac{1}{2}$ % of
17. 8000	21. $60.00	25. $32.32	29. 6080
18. 7025	22. $30.30	26. $40.50	30. 2341
19. 5243	23. $60.18	27. $80.48	31. 9072
20. 3009	24. $90.24	28. $72.20	32. 8264

34 % of	58 % of	150 % of	165 % of
33. 30,025	37. 29,154	41. $66,340	45. $254.54
34. 49,231	38. 36,872	42. $70,802	46. $708.78
35. 12,387	39. 83,001	43. $90,437	47. $899.82
36. 65,000	40. 21,258	44. $72,566	48. $300.76

88 % of	63 % of	92 % of	147 % of
49. 65,432	53. 52,123	57. 61,720	61. 16,008
50. 80,901	54. 74,809	58. 88,000	62. 91,234
51. 72,187	55. 63,880	59. 75,400	63. 78,005
52. 34,000	56. 75,220	60. 39,000	64. 64,032

How to find what per cent one number is of another.

Oral Work

1. What part of 10 is 5 ? What per cent of **10 is 5 ?**

SOLUTION. 5 is ½ of 10, or 50 % of 10.

2. What part of 30 is 3 ? What per cent ?

3. What part of 24 is 6 ? What per cent ?

4. What part of 24 is 18 ? What per cent ?

5. What part of 40 is 8 ? What per cent ?

What per cent of :

6. 12 is 6 ?	**11.** 15 is 5 ?	**16.** $25 is $5 ?
7. 18 is 6 ?	**12.** 16 is 4 ?	**17.** $20 is $4 ?
8. 10 is 10 ?	**13.** 32 is 28 ?	**18.** $64 is $8 ?
9. 24 is 9 ?	**14.** 60 is 5 ?	**19.** $64 is $32 ?
10. 50 is 25 ?	**15.** 16 is 12 ?	**20.** $64 is $16 ?

On a spelling test of 50 words five children made records as follows :

21. John missed 5 words. He missed — %.

22. Mary missed 10 words. She missed — %.

23. Paul missed 15 words. He had — words right. He had — % right.

24. George missed 16 words. He had — % right.

25. Louise missed 2 words. She had — % right.

Each team in a baseball league played 12 games :

26. The first team won 8 and lost 4. It won — %.

27. The second team won 9 and lost 3. It won — %.

28. The third team won 10 and lost 2. It won — %.

29. The fourth team won 6 and lost 6. It won — %.

30. The fifth team won 4 and lost 8. It won — %.

Written Work

1. What per cent of 72 is 18 ?

$18 \div 72 =$

$$
\begin{array}{r}
.25 \\
72\overline{)18.00} \\
14\ 4 \\
\hline
3\ 60 \\
3\ 60 \\
\hline
\end{array}
$$

$18 = \frac{18}{72}$ of 72. Reduce the fraction $\frac{18}{72}$ to a decimal by dividing 18 by 72. The result $= .25$, or 25 %.

What per cent of :

2. 54 is 18 ?	**7.** \$80 is \$50 ?	**12.** \$140 is \$84?
3. 80 is 56 ?	**8.** \$75 is \$15 ?	**13.** \$280 is \$40?
4. 90 is 75 ?	**9.** \$24 is \$16 ?	**14.** \$270 is \$30?
5. 100 is 66⅔ ?	**10.** \$75 is \$50 ?	**15.** \$250 is \$75?
6. 150 is 60 ?	**11.** \$90 is \$36 ?	**16.** \$570 is \$228 ?

17. Marian spells 20 words out of 50 words correctly. What per cent does she get on the spelling test ?

18. What per cent of a yard is a foot ?

19. What per cent of an hour are 15 minutes ?

20. If William earns \$60 and saves \$12, what per cent does he save ?

21. A baseball team wins 20 games out of 35 games played. What per cent of the games played does the team win ?

22. Flour is advanced from \$8 to \$10 a barrel. What is the amount of increase ? the per cent of increase ?

SUGGESTION. \$2 is what per cent of \$8?

23. What per cent of a pound are 6 ounces ?

24. If Edith solves 15 problems out of 20 problems correctly, what per cent will she get ?

25. Find Philip's per cent on an arithmetic test if he solves 12 problems out of 15 problems correctly.

PROFIT AND LOSS

In order to conduct a successful business, the business man must take careful account of profits and losses. The **total cost** is the cost plus all expenses; and the **profit** or **loss** is the difference between the selling price and the total cost.

Such charges as rent, light, heat, insurance, taxes, salaries, etc., are called **overhead charges**. These are not always mentioned in the problems.

If there are both profits and losses in any transaction, the final profit will be the amount of profit in excess of loss; and the final loss, the amount of loss in excess of profit.

1. The Trent Company bought 1000 yd. of cloth @ $1.50. The expenses were $250. They sold 850 yd. @ $2.25 and the remainder @ $1.50. Find the profit.

SOLUTION. $1000 \times \$1.50 = \$1500$, amount paid for cloth.

$\quad \$1500 + \$250 = \$1750$, total cost of cloth (including expenses).

$\quad 850 \times \$2.25 = \$1912.50$, amount received for 850 yd.

$\quad 150 \times \$1.50 = \$225$, amount received for 150 yd.

$\quad \$1912.50 + \$225 = \$2137.50$, total amount received.

$\quad \$2137.50 - \$1750 = \$387.50$, profit.

2. Find the profit or loss on 500 yd. of linen bought @ $.80, with expenses of $25, if 300 yd. were sold @ $1.10 and 200 yd. @ $.70.

3. A merchant bought a quantity of silk for $10,000 and sold it for $15,000. Allowing 20 % of the selling price for overhead charges, what was his profit?

SOLUTION.   20 % of $15,000 = $3000; $10,000 + $3000 = $13,000, total cost; $15,000 - $13,000 = $2000, profit.

4. A house was bought for $12,000 and rented for 1 year for $1200. The expenses amounted to $600. What was the profit or loss if the house was sold at the end of the year for $13,000? if it was sold for $11,000?

5. Find the profit or loss on goods bought for $4000 and sold for $7000, allowing 10 % of selling price for overhead charges.

6. Find the profit or loss on goods bought for $15,000 and sold for $16,000, allowing 25 % of selling price for overhead charges.

7. What was the profit on goods bought for $500 and sold for $800, allowing 20 % of selling price for overhead charges?

8. What was the loss on goods bought for $1200 and sold for $1300, allowing 20 % of selling price for overhead charges?

9. When a dress that cost $15 was sold at an advance of $33\frac{1}{3}$ %, what was the increase? the selling price?

SOLUTION. $\frac{1}{3}$ of $15 = $5, increase; $15 + $5 = $20, selling price.

10. If cloth bought at $500 was sold at a loss of 15 %, what was the selling price?

SOLUTION. 15 % of $500 = $75, loss; $500 − $75 = $425, selling price.

11. Silk costing $500 was damaged by water and sold at a loss of 25 %. What was the loss? the selling price?

12. A house bought for $12,000 was sold at an advance of 80 %. What was the increase? the selling price?

Find the profit or the loss and the selling price on each of the following transactions:

TOTAL COST	RATE OF PROFIT	TOTAL COST	RATE OF LOSS
13. $100	5 %	**19.** $845	3 %
14. $250	20 %	**20.** $434	5 %
15. $300	$33\frac{1}{3}$ %	**21.** $520	10 %
16. $640	25 %	**22.** $315	2 %
17. $700	10 %	**23.** $656	$12\frac{1}{2}$ %
18. $596	40 %	**24.** $768	4 %

25. The total cost of some cloth was $4000 and the selling price was $5000.

   (*a*) What per cent of the cost was the profit?

   (*b*) What per cent of the selling price was the profit?

SOLUTION.   The profit was $5000 − $4000, or $1000.

   (*a*) $1000 = $\frac{1000}{4000}$, or 25 %, of the cost.

   (*b*) $1000 = $\frac{1000}{5000}$, or 20 %, of the selling price.

The *per cent* of profit or loss is reckoned by some business houses on the total cost; by others on the selling price.   In this book, the per cent is to be reckoned on the cost.

26. What per cent of the cost was gained when the total cost of goods was $40 and the selling price was $45?

27. What per cent of the cost was lost when the total cost of goods was $40 and the selling price was $30?

28. When goods costing $11,000 plus $1000 expenses were damaged and sold for $8000, what per cent of the cost was lost?

Find the per cent of profit or loss on each of the following transactions:

TOTAL COST	SELLING PRICE	TOTAL COST	SELLING PRICE
29. $50	$60	**39.** $80	$100
30. $80	$60	**40.** $75	$105
31. $90	$117	**41.** $800	$1000
32. $75	$50	**42.** $800	$700
33. $100	$163	**43.** $250	$400
34. $200	$150	**44.** $250	$150
35. $500	$750	**45.** $750	$1000
36. $850	$765	**46.** $750	$500
37. $880	$990	**47.** $1000	$800
38. $920	$1265	**48.** $1000	$1500

BUYING AT BARGAIN SALES

In order to dispose of goods rapidly, merchants often sell them at a certain per cent less than the marked price. Such a reduction is called a **discount**.

Thus, if a clock marked $15 is sold at a reduction of $33\frac{1}{3}$ %, the rate of discount is $33\frac{1}{3}$ %. The amount of discount is $33\frac{1}{3}$ % of $15, or $5, and the selling price is $15 − $5, or $10.

1. Find the selling price of a dress reduced 40% from $25.

2. Find the selling price of a hat sold at a discount of 50% from $14.

How much is saved on each of the following bargain sales?

	REGULAR PRICE	PER CENT OF DISCOUNT	AMOUNT SAVED
3. Suitcase . . .	$10	20 %	
4. Gas stove . .	$24	$12\frac{1}{2}$ %	
5. Tablecloth . .	$6	25 %	
6. Fountain pen .	$3	$16\frac{2}{3}$ %	
7. Kitchen cabinet	$35	30 %	
8. Rug	$50	50 %	
9. Curtains . . .	$5	10 %	
10. Handbag . . .	$4	$37\frac{1}{2}$ %	

Find the selling price of each of the following articles at a furniture sale :

	REGULAR PRICE	PER CENT OF DISCOUNT	SELLING PRICE
11. Bedstead . . .	$35	20 %	
12. Bookcase . . .	$40	25 %	
13. Chair	$10	10 %	
14. Desk	$27	$33\frac{1}{3}$ %	
15. Couch	$60	$16\frac{2}{3}$ %	
16. Rocker. . . .	$15	$33\frac{1}{3}$ %	

COMMERCIAL DISCOUNT

Merchants who sell their goods to consumers are called **retail merchants**. The retail merchants buy their goods in large quantities from **wholesale merchants** at **wholesale prices**, and they sell them to us in smaller quantities at increased prices, known as **retail prices**.

When wholesalers issue price lists or catalogues, they often allow deductions from the prices, called **trade discounts**, to meet the varying conditions of trade.

Sometimes discounts are allowed for immediate payment of a bill or for payment within a definite time. Such discounts are called **cash discounts** and **time discounts**.

The price less all discounts is called the **net price**.

1. The catalogue price of a piano was $400. The dealer received a discount of 25 %. Find the net price.

Solution. 25 % of $400 = $100, discount; $400 − $100 = $300, net price.

2. A discount of 5 % for cash payment was allowed on a gas bill of $4. What was the net amount paid?

3. Mr. Howland received 3 % discount on a bill for stationery amounting to $500, by paying it in ten days' time. How much did this time discount amount to?

Find the net price of each of the following articles:

	Catalogue Price	Rate of Discount	Net Price
4. Lawn mower	$20	20 %	
5. Automobile	$600	33⅓ %	
6. Farm tractor	$1200	12½ %	
7. Sewing machine	$60	30 %	
8. Piano	$650	40 %	
9. Camera	$25	15 %	
10. Bicycle	$75	20 %	

11. If the catalogue price of a farm tractor is $1000 and the net price is $800, what is the per cent of discount?

SOLUTION. $1000 − $800 = $200, discount; $\frac{200}{1000} = \frac{1}{5} = 20\%$, discount.

12. Find the per cent of discount on a bill for a stove listed at $75 and sold for $50.

13. Find the per cent of discount on a bill for $500 worth of books sold for $400.

14. Find the per cent of discount on a bill of $5000 for silk paid by a check for $3500.

Find the per cent of discount on the following goods :

	CATALOGUE PRICE	NET PRICE	PER CENT OF DISCOUNT
15. Velour coat . . .	$36	$24	
16. Serge cape	$30	$15	
17. Serge dress . . .	$10	$ 7.50	
18. Silk dress	$15	$12.50	
19. Bag	$ 3	$ 2.40	
20. Cap	$ 1	$ .60	
21. Overcoat	$32	$24	
22. Suit	$50	$36	
23. Black lynx scarf . .	$80	$70	
24. Black lynx muff . .	$65	$60	
25. Shirt	$ 1.50	$ 1.20	
26. Shirt	$ 2	$ 1.40	
27. Shirt	$ 2.50	$ 2	
28. Trimmed hat . . .	$15	$12	
29. Trimmed hat . . .	$10	$ 6	
30. Shoes	$10	$ 7	
31. Silk stockings . .	$ 1.50	$ 1	
32. Bedroom suite . .	$60	$40	
33. Bedroom suite . .	$75	$50	
34. Library table . . .	$64	$56	
35. Desk	$54	$36	

COMMERCIAL BILLS

A **commercial bill** differs from an ordinary bill in introducing the element of discount. Sometimes both trade and time discounts are indicated on the bill; but in this book only one discount is given. Study the following bill:

DETROIT, MICH., *Jan. 5, 1920*

The John Grant Company
300 Wood Street
Detroit, Michigan

Bought of THE NATIONAL COMPANY
Detroit, Michigan

TERMS: 30 days net; 2 % cash in 10 days

12 Bookcase Sections # 35 @ $ 1.50	$ 18	00			
12 " Tops # 38 @ $ .90	10	80			
6 " Bases # 34 @ $ 6.00	36	00			
	$ 64	80			
Cash in 10 days, less 2 %	1	30			
			$ 63	50	

Received payment, Jan. 10, 1920
The National Company
Per L. M.

The sign #, when placed before a number, is read "number." Thus, #12 is read "number 12."

The statement "Terms: 30 days net; 2 % cash in 10 days," means that the bill is due in 30 days; but if it is paid within 10 days of its date, a discount of 2 % will be allowed. If it is not paid within 10 days, no discount will be allowed.

Written Work

Make out bills showing net cost price for the following:

1. Mr. King bought for cash from Starr and Mason, Denver, Colo., 4 doz. Acme lawn mowers @ $40, 50 lb. lawn seed @ $.20, 2½ doz. brushes @ $.60. Terms: 30 days net; 2% cash in 10 days.

2. Fiske and Hammond, St. Louis, Mo., bought for cash from the Trow Buggy Company, Cincinnati, Ohio, 72 buggies @ $110, 50 sets harness @ $55, 15 sleighs @ $70, 40 robes @ $30. Terms: 30 days net; 3% cash in 10 days.

3. Jameson and Holland, Greenville, Ohio, bought from The Grant Warren Company, Milwaukee, Wis., 5 doz. handkerchiefs @ $3.60; 5 bolts muslin, 40 yd. each, @ $.25; 5 bolts prints, 42 yd., @ $.20. Trade discount: 33⅓%. Terms: cash.

4. Peter Austin, tailor, Brockton, Mass., orders from Richmond and Company, New York, importers, 3 pieces suiting, 22 yd. each, @ $5.25. Terms: 30 days net; 2% off 10 days. Make out and receipt the bill if paid within 10 days.

Find the net cost of articles listed as follows:

	LIST PRICE	TRADE DISCOUNT	CASH DISCOUNT	NET PRICE
5.	$100	25 %		
6.	$200		5 %	
7.	$500	20 %		
8.	$300		2 %	
9.	$1000	30 %		
10.	$5000		3 %	
11.	$2400	12½ %		

COMMISSION

Oral and Written Work

1. Edith got subscriptions for the *Young People's Magazine* and received as pay, or **commission**, 20 % of the amount. If she got 10 subscriptions at $3 a year, how much commission did she receive?

SOLUTION. $10 \times \$3 = \$30$, amount of subscriptions.
20% of $\$30 = \frac{1}{5}$ of $\$30$, or $\$6$, commission.

2. Charles collected $250 due his father and received 2 % commission. How much did Charles earn?

3. A book agent's sales one week amounted to $500. Find his commission at 30 %.

4. A real estate agent sold a house for $15,000. Find his commission at 5 %.

5. A clerk in a department store received 2 % commission on her sales. In January she sold $900.50 worth of goods. What was her commission?

6. What is the yearly income of a salesman who receives a salary of $2000 and 10 % of his sales of $35,000?

The amount left after the commission has been deducted is called the **net proceeds**.

7. Mr. Brown collected a bill of $1600 for Mr. Dixon and charged 6 % commission. Find the net proceeds received by Mr. Dixon.

SOLUTION. 6% of $\$1600 = \$96$, commission.
$\$1600 - \$96 = \$1504$, net proceeds.

8. Find the net proceeds received from the sale of a house for $5000 at 4 % commission.

9. Find the net proceeds from the sale of $2400 worth of wheat at 3 % commission.

Find the commission:

Sales	Rate of Commission	Purchase	Rate of Commission
10. $500.25	4 %	**23.** $8690	4 %
11. $425.60	5 %	**24.** $1825	1 %
12. $654.20	10 %	**25.** $1743	2 %
13. $782.50	4 %	**26.** $1957	4 %
14. $994.20	5 %	**27.** $1836	5 %
15. $523.50	15 %	**28.** $2550	10 %
16. $672.25	6 %	**29.** $8775	2 %
17. $873.40	8 %	**30.** $5620	3 %
18. $902.30	5 %	**31.** $9990	8 %
19. $376.32	12½ %	**32.** $3400	12 %
20. $262.74	33⅓ %	**33.** $6780	10 %
21. $480.60	16⅔ %	**34.** $7240	15 %
22. $720.96	8⅓ %	**35.** $9750	33⅓ %

Find the net proceeds:

Sales	Rate of Commission	Sales	Rate of Commission
36. $5000	20 %	**49.** $987.80	7 %
37. $2700	33⅓ %	**50.** $165.50	10 %
38. $3600	25 %	**51.** $375.80	8 %
39. $4500	20 %	**52.** $492.75	2 %
40. $5400	16⅔ %	**53.** $244.40	15 %
41. $6400	12½ %	**54.** $553.90	5 %
42. $4800	5 %	**55.** $648.30	12 %
43. $7200	10 %	**56.** $592.60	20 %
44. $8400	4 %	**57.** $804.20	25 %
45. $9600	6 %	**58.** $200.70	3 %
46. $5250	3 %	**59.** $521.10	6 %
47. $4780	2 %	**60.** $643.15	2 %
48. $6140	8 %	**61.** $854.25	4 %

INTEREST

Oral Work

1. James paid $10 for the use of a horse and buggy for one day. What did he get in exchange for the $10?

2. Mr. Hughes paid $15 for the right to pasture his cow in a field for two months. What did he get in exchange for the $15?

3. Mr. Bell paid $6 for the use of $100 for one year. What did he get in exchange for the $6?

4. In the first two examples money was paid for the use of something that is not money. For what did Mr. Bell pay the money in the last example?

Money paid for the use of money is called **interest**.

5. How much did Mr. Bell pay for the use of the money? What is the $6 called?

6. On what is interest reckoned? The $100 is called the *principal*.

The sum on which the interest is paid is called the **principal**.

The per cent of interest on the principal paid for the use of the principal for *one year* is called the **rate of interest**.

Time is always a factor in interest. Interest, then, is the product of three factors — *principal*, *rate*, and *time*.

The sum of the principal and the interest is called the **amount**.

7. Joan had $200 in a savings bank that paid her 4 % interest a year. How much interest did she receive in a year?

SOLUTION. 4 % of $200 = $8, interest.

8. What was the amount of Joan's money in the bank the end of the year?

SOLUTION. $200 + $8 = $208, amount.

9. What is the interest on $1000 for 1 year at 5 %?

10. What is the interest on $1000 for 2 years at 5 %?

11. What is the interest on $650 for 1 year at 6 %?

12. What is the interest on $650 for 3 years at 6 %?

Find the interest for 1 year on the following sums:

13. $200 at 5 %	**21.** $250 at 4 %
14. $300 at 6 %	**22.** $375 at 3 %
15. $600 at 4 %	**23.** $450 at 6 %
16. $700 at 3 %	**24.** $510 at 2 %
17. $900 at 2 %	**25.** $940 at 5 %
18. $500 at 6 %	**26.** $212 at 8 %
19. $400 at 5 %	**27.** $1550 at 5 %
20. $1200 at 8 %	**28.** $2840 at 6 %

Find the interest on the following sums:

29. $300 for 2 yr. at 4 %	**37.** $350 for 2 yr. at 6 %
30. $400 for 3 yr. at 5 %	**38.** $240 for 4 yr. at 5 %
31. $600 for 4 yr. at 6 %	**39.** $170 for 3 yr. at 6 %
32. $500 for 2 yr. at 3 %	**40.** $460 for 5 yr. at 4 %
33. $200 for 5 yr. at 4 %	**41.** $570 for 3 yr. at 5 %
34. $800 for 2 yr. at 3 %	**42.** $630 for 4 yr. at 8 %
35. $900 for 3 yr. at 4 %	**43.** $750 for 5 yr. at 2 %
36. $700 for 2 yr. at 5 %	**44.** $860 for 2 yr. at 6 %

How to find the interest for years and months.

Oral Work

1. What part of a year are 6 months? 4 months? 3 months? 2 months? 1 month?

2. If the interest for 1 year is $120, what should it be for 6 months? for 4 months? for 3 months? for 2 months? for 1 month? for 60 days? for 90 days?

Find the interest on:

3. $100 for $\frac{1}{2}$ year at 6 %   **5.** $1000 for $\frac{1}{4}$ year at 4 %

4. $100 for $1\frac{1}{2}$ years at 6 %   **6.** $800 for $1\frac{1}{4}$ years at 4 %

Written Work

1. What is the interest on $500 for $2\frac{1}{2}$ years at 6 %?

$ 500, principal
    .06, rate
─────────────
$ 30.00, interest for 1 year
       $2\frac{1}{2}$
─────────────
$ 75.00, interest for $2\frac{1}{2}$ years

The interest for 1 year = .06 of the principal, or $30. The interest for $2\frac{1}{2}$ years = $2\frac{1}{2}$ × $30, or $75.

Multiply the principal by the rate and the product by the number of years.

The year is usually considered as 360 days, that is, 12 months of 30 days each.

Find the interest on:

2. $400 for $1\frac{1}{2}$ years at 4 %   **7.** $650 for $2\frac{1}{2}$ years at 3 %

3. $500 for $2\frac{1}{3}$ years at 6 %   **8.** $930 for $1\frac{1}{6}$ years at 6 %

4. $600 for $3\frac{2}{3}$ years at 6 %   **9.** $800 for $2\frac{1}{4}$ years at 4 %

5. $120 for $4\frac{1}{2}$ years at 4 %   **10.** $400 for $\frac{3}{4}$ year at 8 %

6. $450 for $2\frac{1}{2}$ years at 6 %   **11.** $350 for $1\frac{1}{2}$ years at 5 %

Find the interest and the amount on :

    12. $700 at 5 % for 1 yr. **6 mo.**

    13. $800 at 6 % for 2 yr. **4 mo.**

    14. $900 at 4 % for 1 yr. 3 mo.

    15. $450 at 6 % for 2 yr. 6 mo.

    16. $600 at 3 % for 2 yr. 1 mo.

    17. $500 at 6 % for 2 yr. 8 mo.

    18. $540 at 4 % for 1 yr. 9 mo.

    19. $350 at 6 % for 4 yr. 1 mo.

    20. $285 at 6 % for 2 yr. 10 mo.

    21. $620 at 6 % for 3 yr. 2 mo.

    22. $725 at 3 % for 1 yr. 8 mo.

    23. $800 at 4 % for 2 yr. 6 mo.

    24. $975 at 6 % for 1 yr. 5 mo.

    25. $650 at 5 % for 1 yr. 6 mo.

    26. $775 at 6 % for 2 yr. 4 mo.

Find the interest at 6 % on :

27. $200 for 4 mo.   **30.** $750 for 8 **mo.**

28. $400 for 6 mo.   **31.** $300 for 60 **da.**

29. $350 for 2 yr. 3 mo.   **32.** $300 for 90 da.

33. Find the amount necessary to pay a loan of $300 **at 6 %** for $2\frac{1}{2}$ years.

34. Find the interest at 6 % on $900 for $1\frac{1}{4}$ years.

35. A man borrowed $300 to pay for an automobile. Find the amount he must pay at the end of 1 year 6 **months at** 5 % interest.

36. Edward lent a friend $600 for 1 year 4 months at 6 % interest. Find the amount that his friend must pay **him at** the end of the time.

Household Problems

1. Agnes helped her mother to put up jelly in half-pint glasses. If they filled 25 glasses, how many pints were there in all?

2. If you could fill one pie with 1 pint box of berries, how many pies could you fill with 3 quart boxes?

3. Frank picked 10 bu. of apples and sold them to his mother at 30 ¢ a peck. How much did he receive for the apples?

4. If potatoes were bought at 5 lb. for 15 ¢, what was the cost per bushel? (60 lb.)

5. A housekeeper for a hotel bought 8 bu. of peaches for preserving. If they were packed in baskets of 2 pk. each, how many baskets were there?

6. Doris made a strawberry shortcake for which she used 3 cups of flour (1½ lb.) at 8 ¢ a pound, 2 teaspoonfuls of baking powder (⅛ ¢), ¼ lb. of butter at 50 ¢ a pound, ½ pt. of milk at 14 ¢ a quart, 1 box of strawberries at 22 ¢ a box, and ½ pt. of cream at 28 ¢ a pint. Find the cost of the cake.

7. The American Drygoods Company sent by parcel post 4 parcels, each containing a blanket costing $2.15. If the postage on each parcel was 9 ¢, find the total cost of all the blankets, including postage.

8. Fill out the following mail order for groceries:

P. O. Date.........................

LANE and WHITE, New York.

  Please send me goods as per this order:

Mark Packages for...

Street........................... Town...........................

County .... State ....

Indicate whether to be sent by freight or express or parcel post.........

QUANTITY	ARTICLE	PRICE	TOTAL	
$\frac{1}{2}$ doz.	Cans Beans	$ .95		
$1\frac{1}{4}$ doz.	Cans Corn	2.50		
$\frac{1}{4}$ doz.	Cans Asparagus	2.70		
5 lb.	L. and W. Blend Coffee	.32		
$\frac{1}{4}$ doz.	Cans Cocoa	2.28		
$\frac{1}{12}$ doz.	Bottles Mustard	2.75		
$\frac{1}{8}$ doz.	Packages M. T. Oats	1.40		

Signature......................................

Address.................................

Form of remittance (if inclosed)........ ....

---

9. How much did it cost to mail a package of canned goods weighing $3\frac{3}{4}$ lb. in the second zone?

10. The owner of a boarding house bought 9 hams that weighed $82\frac{7}{8}$ lb. What was the average weight?

11. Mrs. Gray exchanged $30\frac{1}{4}$ yd. of lace @ $.12 for lace @ $.03. How many yards of the cheaper lace did she get?

12. At $720 a year, find the rent of a cottage for 3 mo.

13. What change should you receive from $5 if you bought 8 lb. of fish at $24 ¢$ a pound, 3 cans of tomatoes at $1.44 a dozen, and 2 gal. of gasoline at $28 ¢$ a gallon?

14. What was my January milk bill if I used 5 pt. every day at $14 ¢$ a quart?

15. My bill for 3000 lb. of coal was $13.50. At this rate how much must I pay for 10 T. of coal?

16. How many pint cans could be filled from 26 gal. of tomato soup?

17. How much did $3\frac{1}{2}$ bu. of plums cost at 15¢ a quart?

18. Find the amount of the following purchases:

1 doz. boxes of cocoa at 15¢ a box
8 cans of tomatoes at $1.44 a dozen
$11\frac{1}{2}$ lb. ham at 50¢ a pound.

19. Walter picked $4\frac{1}{4}$ bu. of pears and sold them to his mother at 30¢ a peck. How much did he receive?

20. Helen made a sewing bag for a Christmas present. She used $1\frac{1}{2}$ yd. ribbon @ 38¢, $1\frac{7}{8}$ yd. ribbon @ 8¢, and $\frac{7}{8}$ yd. lace @ 24¢. How much did the bag cost her?

21. We burned in January 42 kilowatt hours of electricity at 7¢ a kilowatt hour. Find the cost for the month.

22. Our milkman had a can of milk containing 10 gal. If he sold 3 qt. to the first customer, 4 qt. to the second customer, 3 gal. to the third customer, and 2 gal. 1 pt. to the fourth customer, how much had he left in the can?

23. At $.80 a 1000 cu. ft. find the cost of burning for 85 hr. a month, 2 gas jets, each of which consumed $5\frac{1}{2}$ cu. ft. of gas each hour.

24. George's cow, Bess, averaged $2\frac{1}{2}$ gal. of milk a day for 340 da. If George sold the milk for 10¢ a quart, how much did he receive for it? What was his profit if the cost of keeping the cow was 35¢ a day including labor?

25. Alice made an apron for her sister's birthday present. She used 1 yd. of dotted swiss @ 25¢, 4 yd. of edging @ $12\frac{1}{2}$¢, 3 yd. of beading @ 7¢, and $1\frac{1}{4}$ yd. of ribbon @ 8¢. How much did the apron cost her?

Saving Food and Fuel

1. If each of the 102,000,000 people in the United States should save 1 lb. of wheat flour in one week, how many barrels would be saved that week ?   (196 lb. = 1 bbl.)

2. If 4 slices of bread each day amount to $1\frac{3}{4}$ lb. a week, what is the weight of each slice ?

3. A family of 7 used $1\frac{1}{2}$ lb. of wheat flour per week each. How much was used per week by this family ?   How much per day was used by each person ?

4. If 12 oz. of sugar a week amount to $3\frac{1}{2}$ tablespoonfuls a day, how many tablespoonfuls a day do 8 oz. a week amount to ?

5. A family that formerly consumed $2\frac{1}{2}$ lb. of meat a day reduced their use to 2 lb. What part of the original consumption did they save ?

6. How many tons of coal were burned in 180 days by a family using 100 lb. a day ?   How many tons did this family save in 180 da., if they saved a 5-pound shovelful a day ? At $8.50 a ton how much money did they save ?

7. In making muffins for breakfast Mrs. Clark substituted barley and corn flour for 2 cups of wheat flour.   Each cup of wheat flour weighed $\frac{1}{4}$ lb.   How many pounds of wheat flour did she save in 7 da.?

8. About 170,000,000 cups of tea and coffee are used daily in the United States.   If half a teaspoonful of sugar is left undissolved at the bottom of each cup, how many tons of sugar are wasted per day ?   (100 teaspoonfuls = 1 lb.)

Making Out Sales Slips

If you make purchases in a retail store, the clerk usually fills out a **sales slip** like the following:

Name..................F. B. Edwards..			
Address...................24 Main Street, Buffalo, N. Y..............................			
CLERK NO.	HOW SOLD OR AMOUNT REC'D	AMOUNT OF SALE	DATE
2924	$ 5.00	$ 2.97	9/3/19
QUANTITY	ARTICLE		AMOUNT
1 1/2 yd.	Ribbon	$ .28	42
4 3/8 yd.	Gingham	.50	2 19
2 1/4 yd.	Lace	.16	36
		Total	2 97
		Change due	2 03

By the aid of carbon paper the clerk makes two copies at once. One is given to the customer and the other is kept by the clerk.

Make out sales slips, like above model, for the following:

1. $6\frac{1}{2}$ yd. serge @ $2, 1 pair gloves @ $1.75, $2\frac{1}{2}$ doz. buttons @ $.65. Amount received, $20.

2. $5\frac{7}{8}$ yd. silk @ $1.75, 3 yd. lining @ $.12$\frac{1}{2}$, 6 spools thread @ $.06. Amount received, $11.50.

3. 3 cans peas @ $.25, 4 cans asparagus @ $.35, $1\frac{1}{4}$ doz. eggs @ $.45, $\frac{3}{4}$ lb. tea @ $.34. Amount received, $5.00.

4. $3\frac{1}{2}$ lb. butter @ $.45, $2\frac{1}{2}$ lb. cheese @ $.35, 2 bottles olives @ $.12, 3 lb. nut butter @ $.32, $3\frac{1}{2}$ lb. Victory flour for $.25. Amount received, $5.00.

Applications of Percentage

1. Mary has $24 in the savings bank, and deposits 25 % as much as she has in the bank. Find the amount she deposits.

2. Mr. Wells finds that he spends 300 hours a year in going to market when he drives a team, but with his auto truck he saves 60 % of the time. How many hours does he save by the use of the auto truck?

3. John has saved $120, and adds 40 % to this amount. How much does he add?

4. Henry travels 480 miles at $.03 a mile ; his three meals cost $.90 each and his sleeper $2.50. If his other expenses are 5 % of these three items, find his total expenses on the trip.

5. Paul buys a set of tools for $18.90 and his father pays for 40 % of the bill. How much is left for Paul to pay?

6. A man borrows $1000, and pays the lender 5 % for the use of the money for 1 year. How much does he pay for its use?

7. Find the interest on $1000 at 5 % for 2 yr.

8. Find the interest on $1000 at 5 % for 2 yr. 6 mo., or $2\frac{1}{2}$ yr.

9. Find the interest on $2000 at 6 % for 1 yr.; for 2 yr.

Find the interest on :

10. $100 for 2 yr. at 4 %.   **12.** $3000 for $1\frac{1}{4}$ yr. at 4 %.

11. $500 for $1\frac{1}{2}$ yr. at 6 %.   **13.** $5000 for $1\frac{1}{6}$ yr. at 6 %.

14. In a spelling test of thirty words, Edith misses 20 %. How many words does she spell correctly?

15. James has a collection of 1200 stamps. If 20 % are United States stamps and $33\frac{1}{3}$ % English stamps, how many stamps are from other countries?

Mr. Pratt made the following sales. Find his commission for each day at 8 % :

16. Monday, $1200

17. Tuesday, $1695

18. Wednesday, $2950

19. Thursday, $2450

20. Friday, $1720

21. Saturday, $2475

22. Find his total commission for the week.

23. A real estate agent sold a house and lot for $8760, charging 2 % commission. Find his commission.

24. A traveling salesman sold $60,000 worth of goods in a year, at a commission of 8 %. If his expenses for the year were $2200, how much had he left?

25. An agent rented 12 houses at $40 per month. If he received 5 % for collecting rents, how much was remitted to the owners each month?

26. George and Philip were employed in a factory. George worked 300 days in the year at $2.00 a day, and Philip worked 280 days in the year at $2.50 a day. George deposited 20 % of his earnings in the savings bank, and Philip deposited 25 % of his earnings. Find their total deposits for the year in the savings bank.

27. Mrs. Burt promised her son Alfred and her daughter Louise to add 20 % to their total savings each year. Alfred saved $180 for the year; and Louise, $150. How much money did the mother have to add to the earnings of each?

28. Alice earned $2.50 a day, and put 10 % of her earnings in the savings bank. If she worked 296 days in the year, how much did she deposit in the savings bank?

29. Peter worked in vacation for $65 a month. If he worked 2 mo. and saved 50 % of his money, how much money did he save?

PROBLEMS WITHOUT NUMBERS

1. If you know the weight of a parcel and its destination by parcel post, how can you tell the amount of postage it will require?

2. How can you tell what part one number is of another?

3. How can you find a number when a fractional part of it is known?

4. If you know Walter's per cent in a spelling test and the number of words in the test, how can you tell how many words he had right?

5. If you know the total number of games played by a baseball team and the number of games won, how can you find what per cent was won? How can you find what per cent was lost?

6. If you know how much your father paid for a house and how much he sold it for, how can you find the increase or loss? How can you find the per cent of increase or loss?

7. If you consult a catalogue of sporting goods and know that you will receive a certain per cent of discount from the prices, how can you tell what discount you will receive on each article? How can you tell how much each article will cost you?

8. If you know the original price and the reduced price of an article, how can you tell the per cent of discount?

9. George picked apples, agreeing to accept as commission a certain per cent of the amount received for them. How could he tell how much commission was due him?

10. A friend has lent you a sum of money for a given time at a given rate of interest. How can you tell how much interest is due him?

TESTS FOR ACCURACY AND SPEED

NOTE. — In these exercises the pupils may occasionally "run number races," to see how many correct answers each pupil can get in a given time. Establish a class standard and let each pupil drill until he has reached it.

Add and test:

1.	$54.45	5.	$72.50	9.	$ 8.557
	8.07		5.07		9.039
	62.09		89.09		16.909
	40.93		20.98		41.005

2.	$3.75	6.	$56.905	10.	$347.65
	5.06		12.35		.001
	8.02		15.024		10.10
	9.04		18.014		25.004

3.	1.1	7.	120.2601	11.	36.15
	4.01		230.3102		9.0099
	1.0101		.0563		128.37
	5.055		3.7		16.0875

4.	$5678.00	8.	$9800.00	12.	.008
	265.21		90.00		4.5
	24.50		.09		40.789
	.98		1.98		.002
	1.50		.78		4.10
	.78		24.78		.98
	275.25		324.67		46.06
	25.90		56.09		1.98

Subtract and test:

13.	720,023 545,637	**24.**	430,023 287,645	**35.**	$1023.02 984.57
14.	500,678 375,989	**25.**	200,102 145,678	**36.**	$6000.07 4875.69
15.	304,201 246,879	**26.**	506,102 398,469	**37.**	4501.031 2789.365
16.	246,702 176,496	**27.**	450,021 387,346	**38.**	3001.084 2453.899
17.	310,432 287,467	**28.**	451,002 367,894	**39.**	1000.02 986.568
18.	$4506.12 2752.39	**29.**	$4167.01 988.78	**40.**	$2003.45 1463.84
19.	$40.275 39.009	**30.**	$9.02 6.78	**41.**	$29.72 8.95
20.	.75 .1825	**31.**	.3216 .275	**42.**	4.205 1.7856
21.	38. 18.276	**32.**	45.67 12.09	**43.**	125.50 87.432
22.	230.4897 116.5988	**33.**	100.001 99.9	**44.**	1001.101 900.909
23.	1.1 .999	**34.**	5.05 .6565	**45.**	8.25 .0085

Find the products:

46. $125 \times \$640$	**60.** $.08\frac{1}{3} \times \$9600$
47. $175 \times \$600$	**61.** $.8\frac{1}{3} \times 9000$
48. $1.8 \times \$2000$	**62.** $.06\frac{1}{4} \times 2400$
49. $99 \times \$75.50$	**63.** $.6\frac{1}{4} \times 2400$
50. $1001 \times \$50$	**64.** $.12\frac{1}{2} \times 7200$
51. $.12\frac{1}{2} \times \$2400$	**65.** $.03\frac{1}{3} \times 3300$
52. $.33\frac{1}{3} \times \$60$	**66.** $.3\frac{1}{3} \times \$3300$
53. $33\frac{1}{3} \times \$48$	**67.** $10.5 \times \$62.30$
54. $1007 \times \$7.50$	**68.** 9.5×9500
55. $96 \times \$325.50$	**69.** 7.5×124
56. $.84 \times \$273.50$	**70.** 9.6×5.032
57. $.87\frac{1}{2} \times \$888.80$	**71.** 7.32×59.614
58. $.62\frac{1}{2} \times \$166.40$	**72.** $8.54 \times .0005$
59. $.16\frac{2}{3} \times \$666.60$	**73.** $.0355 \times 6758.4$

Find the quotients:

74. $17,063 \div 59$	**88.** $212,060 \div 350$
75. $210,415 \div 344$	**89.** $\$793.44 \div 348$
76. $\$353.97 \div 207$	**90.** $\$293.23 \div 497$
77. $\$84 \div \$.021$	**91.** $180 \div 600$
78. $\$8.40 \div 210$	**92.** $180 \div .60$
79. $960 \div .004$	**93.** $1800 \div .06$
80. $24 \div .12$	**94.** $1.8 \div 30$
81. $240 \div .12$	**95.** $45 \div 150$
82. $24 \div .012$	**96.** $450 \div .15$
83. $2.4 \div .12$	**97.** $.45 \div 150$
84. $.84 \div .042$	**98.** $4500 \div 1500$
85. $84 \div 420$	**99.** $.045 \div 1.5$
86. $18 \div .6$	**100.** $.0045 \div 150$
87. $180 \div .06$	**101.** $45 \div .015$

Add :

102. 5 yd. 2 in.
3 yd. 9 in.

104. 2 pk. 2 qt.
1 pk. 5 qt.

106. 3 mi. 100 rd.
2 mi. 200 rd.

103. 30 min. 58 sec.
15 min. 5 sec.

105. 8 lb. 2 oz.
7 lb. 9 oz.

107. 8 yr. 3 mo.
5 yr. 6 mo.

Subtract :

108. 5 ft. 9 in.
3 ft. 10 in.

110. 5 yd. 1 ft.
2 yd. 2 ft.

112. 4 doz. 5
2 doz. 10

109. 10 mi. 4 rd.
3 mi. 9 rd.

111. 10 wk. 3 da.
7 wk. 4 da.

113. 6 lb. 3 oz.
2 lb. 5 oz.

Change to decimals :

114. $\frac{3}{4}$ **117.** $\frac{5}{16}$ **120.** $\frac{4}{25}$ **123.** $\frac{4}{9}$ **126.** $\frac{3}{16}$

115. $\frac{7}{8}$ **118.** $\frac{3}{20}$ **121.** $\frac{4}{5}$ **124.** $\frac{10}{11}$ **127.** $\frac{7}{16}$

116. $\frac{3}{8}$ **119.** $\frac{8}{9}$ **122.** $\frac{6}{7}$ **125.** $\frac{5}{12}$ **128.** $\frac{7}{20}$

Change to decimals of not more than four places :

129. $\frac{7}{15}$ **132.** $\frac{16}{19}$ **135.** $\frac{15}{64}$ **138.** $\frac{7}{19}$ **141.** $\frac{11}{14}$

130. $\frac{5}{11}$ **133.** $\frac{5}{36}$ **136.** $\frac{11}{24}$ **139.** $\frac{13}{18}$ **142.** $\frac{11}{15}$

131. $\frac{21}{22}$ **134.** $\frac{13}{15}$ **137.** $\frac{5}{13}$ **140.** $\frac{7}{60}$ **143.** $\frac{8}{15}$

Change to common fractions :

144. $.37\frac{1}{2}$ **148.** $.83\frac{1}{3}$ **152.** $.62\frac{1}{2}$ **156.** $.12\frac{1}{2}$

145. $.41\frac{2}{3}$ **149.** $.06\frac{1}{4}$ **153.** $.33\frac{1}{3}$ **157.** $.14\frac{2}{7}$

146. $.66\frac{2}{3}$ **150.** $.04\frac{1}{6}$ **154.** $.31\frac{1}{4}$ **158.** $.58\frac{1}{3}$

147. $.24\frac{1}{6}$ **151.** $.08\frac{1}{3}$ **155.** $.03\frac{1}{3}$ **159.** $.87\frac{1}{2}$

Change to improper fractions, whole, or mixed numbers:

160. $2\frac{1}{8}$ **162.** $3\frac{1}{16}$ **164.** $13\frac{1}{3}$ **166.** $12\frac{5}{6}$

161. $3\frac{3}{4}$ **163.** $\frac{19}{8}$ **165.** $\frac{17}{6}$ **167.** $\frac{34}{3}$

Change to lowest terms:

168. $\frac{12}{36}$ **170.** $\frac{36}{48}$ **172.** $\frac{15}{66}$ **174.** $\frac{25}{30}$

169. $\frac{40}{50}$ **171.** $\frac{24}{40}$ **173.** $\frac{49}{56}$ **175.** $\frac{63}{72}$

Find the cost of:

176. 64 yd. @ $12\frac{1}{2}$ ¢   **179.** 30 lb. @ $33\frac{1}{3}$ ¢

177. 27 yd. @ $66\frac{2}{3}$ ¢   **180.** 43 lb. @ $87\frac{1}{2}$ ¢

178. 24 lb. @ $16\frac{2}{3}$ ¢   **181.** 12 yd. @ 1.33\frac{1}{3}$

Find the number of yards that can be bought for:

	AMOUNT	PRICE		AMOUNT	PRICE
182.	$15	$.25	**185.**	$48	$.12$\frac{1}{2}$
183.	$10	$.50	**186.**	$66	$.33$\frac{1}{3}$
184.	$6	$.75	**187.**	$28	$.87$\frac{1}{2}$

First add; then subtract:

188. $8\frac{1}{2}$ **190.** $13\frac{7}{8}$ **192.** $7\frac{2}{3}$ **194.** $19\frac{5}{12}$
$\quad\;\;2\frac{3}{4}$ $\qquad\;\;5\frac{5}{16}$ $\qquad\;3\frac{1}{4}$ $\qquad\;16\frac{1}{6}$

189. $25\frac{3}{16}$ **191.** $36\frac{1}{9}$ **193.** $54\frac{3}{10}$ **195.** $49\frac{1}{4}$
$\quad\;18\frac{3}{8}$ $\qquad\;19\frac{1}{6}$ $\qquad\;28\frac{2}{5}$ $\qquad\;25\frac{3}{10}$

Find the products:

196. $9 \times \frac{7}{9}$ **198.** $\frac{8}{8} \times \frac{3}{16}$ **200.** $2\frac{1}{2} \times 3\frac{5}{8}$

197. $32 \times \frac{3}{8}$ **199.** $\frac{3}{4}$ of $1\frac{2}{5}$ **201.** $4\frac{5}{6} \times 5\frac{1}{10}$

Find the quotients:

202. $20 \div \frac{5}{6}$ **204.** $\frac{5}{8} \div \frac{3}{16}$ **206.** $2\frac{1}{4} \div 3\frac{5}{8}$

203. $12 \div \frac{3}{8}$ **205.** $\frac{2}{5} \div \frac{5}{8}$ **207.** $3\frac{2}{3} \div 2\frac{1}{2}$

Find :

208.	5 % of 100		**213.**	$37\frac{1}{2}$ % of 800
209.	10 % of 550		**214.**	75 % of 2400
210.	$33\frac{1}{3}$ % of 900		**215.**	15 % of 750
211.	$16\frac{2}{3}$ % of 1200		**216.**	34 % of 890
212.	$12\frac{1}{2}$ % of 400		**217.**	65 % of 750

Find the profit or loss :

	Total Cost	Rate of Profit		Total Cost	Rate of Loss
218.	$100	5 %	**220.**	$150	$66\frac{2}{3}$ %
219.	$240	$12\frac{1}{2}$ %	**221.**	$600	20 %

Find the per cent of profit or loss :

	Total Cost	Selling Price		Total Cost	Selling Price
222.	$60	$90	**224.**	$500	$400
223.	$40	$35	**225.**	$200	$300

Find the discount and the net price :

	List Price	Rate of Discount		List Price	Rate of Discount
226.	$40	10 %	**228.**	$24	25 %
227.	$80	$12\frac{1}{2}$ %	**229.**	$240	5 %

Find the commission :

	Sales	Rate of Commission		Purchase	Rate of Commission
230.	$500	3 %	**232.**	$3000	12 %
231.	$200	5 %	**233.**	$4000	15 %

Find the interest and the amount :

	Prin.	Rate	Time		Prin.	Rate	Time
234.	$100	6 %	1 yr.	**238.**	$600	5 %	$\frac{1}{2}$ yr.
235.	$200	4 %	2 yr.	**239.**	$850	6 %	1 yr. 4 mo.
236.	$300	5 %	3 yr.	**240.**	$950	3 %	2 yr. 6 mo.
237.	$400	3 %	4 yr.	**241.**	$880	4 %	2 yr. 3 mo.

Oral Work

1. Ruth bought $\frac{1}{2}$ dozen oranges at $.60 a dozen and $\frac{1}{4}$ dozen lemons at $.36 a dozen. Find the amount of her bill.

2. If Ruth handed the clerk $1, how much change should she receive?

3. John's father worked 44 hours a week at $.75 an hour. What were his weekly wages?

4. Alice bought a remnant of $3\frac{1}{2}$ yards of silk for $7. How much did she pay per yard?

5. How much did Alice save if the regular price of the silk was $2.30 per yard?

6. A 50-trip railroad ticket cost $15. What was the price per trip?

7. Find the amount of Mary's bill for $1\frac{1}{2}$ dozen eggs @ $.60 and $1\frac{1}{2}$ lb. butter @ $.70.

8. Mr. Parker could rent a house in the city for $80 a month or a cottage in a suburb for $50 a month. Which would be cheaper by the year and how much, allowing $100 a year railroad fare for Mr. Parker and his family?

9. How much was saved by buying 3 lb. of potatoes for $.13 instead of at $.06 a pound?

10. Walter mailed a package of books weighing 3 lb. to the third zone. The parcel postage was $.06 for the first pound and $.02 for each additional pound, plus a 2-cent service charge. How much postage did Walter pay?

11. Susan bought 4 handkerchiefs at $.12$\frac{1}{2}$ each. How much change did she receive from $1?

12. Find the profit per dozen cans of beans bought at $1.40 a dozen and sold at $.15 a can.

13. Dorothy made $5\frac{1}{4}$ lb. of fudge and $3\frac{3}{4}$ lb. of molasses candy for a fair. How many pounds did she make in all?

14. Lucy weighed $61\frac{1}{2}$ lb., but lost $5\frac{1}{4}$ lb. How much did she then weigh?

15. How many badges containing $\frac{3}{8}$ yd. each can be made from 3 yd. of ribbon?

16. A piece of ribbon is 10 yd. long. After you have cut off $3\frac{5}{8}$ yd. how much is left?

17. Jane earned $50 and deposited $10 in the school savings bank. What part of her earnings did she deposit?

18. Arthur rode 5.2 miles on his bicycle on Monday and 8.8 miles on Tuesday. How far did he ride in the two days? How much farther did he ride on Monday than on Tuesday?

19. Mr. Arnold, who earned $2400 a year, spent .3 of this amount for food for his family and .2 of it for clothing. How much did he spend for each item?

20. A man who earned $3000 a year spent 20 % of it for rent. How much rent did he pay?

21. Thomas bought a book that cost $1.50 at a discount of $33\frac{1}{3}$ %. How much did he pay for it?

22. James picked cherries and sold them for $25, receiving a commission of 10 %. How much did his commission amount to?

23. At a bargain sale, suits are marked down 25 % from $32. What price must be paid for these suits?

24. In a spelling test Anna missed 5 words out of 100. What per cent did she get?

25. If a grocer buys corn at $.30 a dozen and sells it at $.40 a dozen, what per cent does he gain?

26. Peter borrowed $500 for 1 year at 6 % to help him through college. How much interest did he have to pay?

Written Work

Date	Checks	Date	Deposits
2	$191.66	4	$1229.75
3	25.90	6	10.00
9	19.63	9	691.67
10	5.00	10	15.43
17	3.75	16	16.25
23	6.93	24	354.15

1. A monthly statement from a bank was carelessly typewritten as shown at the left. Why do you find difficulty in adding the columns? Rearrange the account properly. Then find the totals of checks and of deposits and the balance.

2. The Bureau of Labor reported 3,235,000 bbl. of wheat flour on hand in 1918 and 3,940,000 bbl. in 1919. Find the amount of increase in barrels of wheat flour.

3. The United States naval airplane NC 4 made the first transatlantic flight from Rockaway, New York, to Plymouth, England, a distance of 3925 mi., in 55 hr. 33 min. of actual flying time. Find, to tenths, the average speed per hour.

4. Find, to tenths, the average speed per hour of the British airplane that made the first non-stop flight across the Atlantic from Newfoundland, Canada, to Clifton, Ireland, a distance of 1980 mi., in 16 hr. 12 min.

5. The British balloon ship R 34 made the first westward flight across the Atlantic from East Fortune, Scotland, to Mineola, New York, a distance of 3200 mi., in 108 hr. Find, to tenths, the average speed per hour.

6. A subway used 38 mi. or 3000 T. of rails a year. Find the number of tons used per mile.

7. Kate needed $5\frac{1}{2}$ yd. of ribbon at $.24 a yard for a sewing bag. How much would she save by buying two remnants — $2\frac{3}{8}$ yd. for $.50, and $3\frac{1}{4}$ yd. for $.75? How much ribbon would she waste?

8. Elizabeth bought 6 handkerchiefs at $12\frac{1}{2}$ ¢ each, $4\frac{1}{2}$ yd. of lace at 27 ¢ a yard, and an umbrella for $3.98. How much change did she get from $10?

9. My school desk is $2\frac{2}{3}$ feet long and $1\frac{3}{4}$ feet wide. Find the perimeter of the desk or the distance around it.

10. John lives $1\frac{3}{5}$ miles from the schoolhouse. After he has walked $\frac{2}{15}$ of a mile, how much farther has he to go?

11. A sheet of cardboard is $\frac{1}{12}$ of an inch thick. What is the thickness of a pile consisting of 30 sheets?

12. Arthur has a number of pads each $\frac{3}{4}$ of an inch thick, which he places in a pile. The pile measures 21 inches. How many pads are there in the pile?

13. How many badges of ribbon, each $1\frac{2}{3}$ yards long, can be cut from a piece of ribbon 10 yards long?

14. A remnant of $2\frac{7}{8}$ yards of silk costs $4.60. What is the price per yard?

15. How many feet of molding are required to extend around a room $20\frac{3}{4}$ feet long and $15\frac{2}{3}$ feet wide?

16. Ruth puts up jelly in glasses containing $\frac{5}{8}$ of a pint each. How much jelly is needed to fill 3 dozen glasses?

17. Mrs. Crane needs $23\frac{7}{8}$ yards of net for curtains. She gets three remnants, two of which measure $5\frac{3}{4}$ yards and $12\frac{1}{2}$ yards. What is the length of the third remnant?

18. Irene walks $2\frac{7}{10}$ miles an hour. How long does it take her to walk 9 miles?

19. How many glasses are required to put up $12\frac{1}{2}$ pints of jelly with $\frac{5}{8}$ of a pint in each?

20. Peter bought a 50-trip railroad ticket for $16.72. His brother John used 9 trips and his brother Paul 20 trips. What part of the total trips did each brother use? How much did each owe to Peter for these trips?

21. When Ethel stood on the scale with her bag of books she weighed 80¾ pounds. Without the bag she weighed 76⅛ pounds. What was the weight of the bag of books?

22. An airplane averaged 2.8 mi. a minute. How many miles did it travel in 1¼ hr.?

23. If 17.3 gal. of gasoline were used for a 100-mile run of an automobile on an earth road, find the cost at $.25 a gallon.

24. How much would be saved on a 100-mile run of this automobile on a concrete road, if only 8.49 gal. of gasoline at $.25 a gallon were used?

25. An airplane covered 200 mi. in 3.75 hr. Find its average speed per hour.

26. If 57 students each wore a badge 5½ in. long, how many yards and inches of ribbon were needed to make the badges?

27. How many 4-ounce packages of soda could be put up from 1 T. 3 cwt. 75 lb. of soda?

28. Find the length of a double-track railroad laid with 1640 rails, each 30 ft. in length.

29. A building was 34 ft. 2 in. wide, and twice as long as wide. Find the distance around the walls.

30. A train left Cary at 9.20 A.M. and arrived at Lynn at 8.20 P.M. The distance between the two cities was 440 mi. Find the number of miles an hour the train traveled.

31. Mr. Dixon bought 80 A. of land for $12,800 and sold it at 25 % gain. How much did he receive per acre?

32. Mr. Hoyt bought a house for $4800 and sold it for $5600. What was his gain per cent?

33. Mr. Hopkins owned a cow that averaged 3 gal. 2 qt. of milk daily. If he sold the milk at $.08 a quart, how much did he realize from the cow during the month of April?

34. How much commission, at 15 %, did a salesman receive for selling goods to the amount of $15,700?

35. Allowing 52 weeks to a year, what is the average number of weeks to a month? Which is greater, and how much per month, a salary of $24 a week or $100 a month?

36. A family with an income of $2000 a year spent 30% of it for food, 15% for clothing, and 20% for rent. How much was paid for each of these items?

37. An agent sold $10,560 worth of goods at 3% commission. How much did the owner realize from the sale?

38. Mr. Perkins had 4 cows — Daisy, Bossy, Lucy, and Beth. The following table shows the number of pounds of milk each gave in a certain week, and the per cent of butter fat. Find the number of pounds of butter fat each cow produced that week.

NOTE. — Butter fat is the richest part of the milk from which butter is made. A 5% milk contains 5 lb. of butter fat to every 100 lb. of milk.

	DAISY	BOSSY	LUCY	BETH
Pounds of milk	210	198	190	206
Per cent of butter fat	4	5	4	3

39. Mr. Clark had a salary of $270 a month. He saved $16\frac{2}{3}$% of it. How much did he save in a year?

40. Mr. Lane borrowed $5500 for 1 year 6 months at 6%. How much interest did he have to pay?

41. How much would Mr. Lane have saved on his debt with interest at 5%?

42. Mr. Foster earned $2400 a year. He spent $800 for food, $480 for rent, and $400 for clothing. What per cent of his income did he spend for each item?

43. The average family paid 84% more for food in 1919 than in 1913. Find the amount paid in 1919 by a family that paid $592.75 in 1913; by a family that paid $640.50 in 1913.

SUPPLEMENT

NOTE. — The following subjects, which were purposely omitted from the body of the book, are here presented for the convenience of teachers who think it desirable to teach them. The word " number " as referred to on pp. 281–283 means integral number.

PRIME FACTORS

A number that has no factors (p. 26) except itself and **1** is called a **prime number**. Thus, $5 = 5 \times 1$; $7 = 7 \times 1$. 5 and 7 are prime numbers.

A factor that is a prime number is called a **prime factor**. Thus, 3 and 7 are prime factors of 21.

Find the prime factors of : 12, 21, 27, 32, 35, 40, 45, 52, 60.

Written Work

1. Find the prime factors of 120.

$$\begin{array}{r|r} 2 & 120 \\ \hline 2 & 60 \\ \hline 2 & 30 \\ \hline 3 & 15 \\ \hline & 5 \end{array}$$

Divide 120 by the prime factor 2, which gives the quotient 60. Divide 60 and the succeeding quotients by the smallest prime factors that will divide each. The last quotient, 5, is a prime number. The prime factors of 120 are 2, 2, 2, 3, 5 ; that is, $120 = 2 \times 2 \times 2 \times 3 \times 5$

Every number is equal to the product of all its prime factors.

2. Find the prime factors of 700.

$$\begin{array}{r|r} 100 & 700 \\ \hline & 7 \end{array}$$

$100 = 10 \times 10 = 2 \times 5 \times 2 \times 5$
$700 = 2 \times 5 \times 2 \times 5 \times 7$

We see at a glance that $700 = 100 \times 7$, or $10 \times 10 \times 7$. Since the factors of 10 are 2 and 5, the factors of 700 are 2, 5, 2, 5, and 7.

Find the prime factors of :

3. 96	**5.** 240	**7.** 600	**9.** 1701
4. 100	**6.** 360	**8.** 900	**10.** 2142

GREATEST COMMON DIVISOR

Oral Work

1. Name a number that will divide 8 and 12 exactly ; 10 and 15 ; 12 and 16.

A number that exactly divides each of several numbers is called a **common divisor.** Thus, 3 is a common divisor of 18 and 27.

The greatest number that exactly divides each of several numbers is called their **greatest common divisor (g. c. d.).** Thus, 9 is the g. c. d. of 18 and 27.

2. Name the g. c. d. of 12 and 16; of 20 and 30; of 18 and 27 ; of 10 and 15 ; of 22 and 33; of 63 and 81.

The greatest common divisor of two or more numbers is the product of all their common prime factors.

Written Work

1. Find the greatest common divisor of 18, 36, and 48.

$18 = 2 \times 3 \times 3$
$36 = 2 \times 2 \times 3 \times 3$
$48 = 2 \times 2 \times 2 \times 2 \times 3$
g. c. d. $= 2 \times 3$, or 6

As the g. c. d. of two or more numbers is the product of all their common prime factors, resolve each number into its prime factors and find which factors are common to all the numbers. 2 and 3 are all the common prime factors of the numbers. Hence the g. c. d. of 18, 36, and 48 is 2 × 3, or 6.

Find the greatest common divisor of :

2. 72 and 108	**6.** 54, 72, and 81	**10.** 22, 33, and 55
3. 36 and 90	**7.** 56, 80, and 96	**11.** 35, 49, and 84
4. 42 and 63	**8.** 35, 45, and 90	**12.** 28, 70, and 77
5. 26 and 39	**9.** 40, 60, and 90	**13.** 32, 48, and 80

LEAST COMMON MULTIPLE

Oral Work

1. Name a number that contains 3 and 4 a whole **number of** times ; 4 and 5.

A number that is exactly divisible by each of several num-**bers** is called a **common multiple** of these numbers. Thus, **24** is a common multiple of 3 and 4.

The least number that is exactly divisible by each **of** several numbers is called their **least common multiple (l. c. m.).** **Thus**, 12 is the l. c. m. of 3 and 4.

2. Name the l. c. m. of 4 and 5 ; of 6 and 8 ; of 6 and **9.**

The least common multiple of two or more numbers is the *product of all their prime factors, each used as often as it occurs* *in any one of the numbers.*

Written Work

1. Find the l. c. m. of 16 and 24.

$16 = 2 \times 2 \times 2 \times 2$
$24 = 2 \times 2 \times 2 \times 3$

2 occurs 4 times as a factor in 16. It must, therefore, be used 4 times in the l. c. m. 3 oc-curs once as a factor in 24. It must, therefore, be used once in the l. c. m. Hence the l. c. m. of 16 and 24 is $2 \times 2 \times 2 \times 2 \times 3$, or 48.

2. Find the l. c. m. of 6, 12, 16, and 24.

```
2| 6  12  16  24
       2|  8  12
          2|4   6
             2   3
```

Since 6 and 12 are exact divisors of 24, a multiple of 24 is also a multiple of 6 and 12 ; hence 6 and 12 may be rejected. Divide the re-maining numbers by any prime factor that will divide *two or more of* them. In the same way divide the quotients until *no two of them* have a common divisor. The product of the divisors and the last quo-tient is the l. c. m. Therefore the l. c. m. of 6, 12, 16, and 24 is $2 \times 2 \times 2 \times 2 \times 3$. or 48.

Find the least common multiple of:

3. 8, 12, 16	**14.** 64, 72, 108	**25.** 27, 45, 63
4. 18, 24, 36	**15.** 72, 84, 120	**26.** 28, 40, 56
5. 14, 21, 42	**16.** 54, 81, 135	**27.** 36, 48, 64
6. 27, 54, 63	**17.** 15, 20, 40	**28.** 32, 52, 65
7. 32, 48, 96	**18.** 16, 24, 32	**29.** 50, 80, 90
8. 36, 54, 63	**19.** 20, 35, 42	**30.** 55, 75, 88
9. 12, 16, 20	**20.** 14, 20, 30	**31.** 24, 28, 40
10. 24, 48, 60	**21.** 15, 25, 35	**32.** 36, 40, 50
11. 35, 56, 63	**22.** 16, 24, 32	**33.** 40, 50, 60
12. 30, 50, 100	**23.** 25, 50, 75	**34.** 33, 44, 88
13. 20, 25, 30	**24.** 50, 60, 70	**35.** 54, 81, 90

Note. — The chief application of least common multiple is in finding the least common denominator of several fractions, in order to make them similar.

Change the following to similar fractions having the least common denominator.

36. $\frac{1}{2}, \frac{1}{8}, \frac{1}{16}$	**45.** $\frac{2}{3}, \frac{3}{4}, \frac{3}{8}$	**54.** $\frac{3}{25}, \frac{1}{50}, \frac{1}{75}$
37. $\frac{1}{3}, \frac{1}{5}, \frac{1}{9}$	**46.** $\frac{3}{4}, \frac{5}{6}, \frac{5}{8}$	**45.** $\frac{3}{20}, \frac{7}{60}, \frac{3}{40}$
38. $\frac{1}{4}, \frac{1}{5}, \frac{1}{6}$	**47.** $\frac{5}{6}, \frac{5}{9}, \frac{5}{8}$	**56.** $\frac{7}{50}, \frac{3}{10}, \frac{3}{100}$
39. $\frac{1}{5}, \frac{1}{6}, \frac{1}{7}$	**48.** $\frac{7}{8}, \frac{7}{16}, \frac{7}{40}$	**57.** $\frac{7}{11}, \frac{1}{22}, \frac{1}{33}$
40. $\frac{1}{6}, \frac{1}{7}, \frac{1}{8}$	**49.** $\frac{8}{9}, \frac{8}{15}, \frac{7}{30}$	**58.** $\frac{7}{12}, \frac{5}{36}, \frac{5}{72}$
41. $\frac{1}{7}, \frac{1}{8}, \frac{1}{9}$	**50.** $\frac{9}{10}, \frac{1}{20}, \frac{1}{50}$	**59.** $\frac{8}{15}, \frac{1}{30}, \frac{1}{60}$
42. $\frac{1}{8}, \frac{1}{9}, \frac{1}{10}$	**51.** $\frac{5}{11}, \frac{1}{22}, \frac{1}{44}$	**60.** $\frac{3}{14}, \frac{3}{28}, \frac{5}{42}$
43. $\frac{1}{9}, \frac{1}{10}, \frac{1}{20}$	**52.** $\frac{5}{12}, \frac{5}{24}, \frac{7}{60}$	**61.** $\frac{5}{16}, \frac{9}{32}, \frac{3}{64}$
44. $\frac{1}{5}, \frac{1}{10}, \frac{1}{15}$	**53.** $\frac{4}{15}, \frac{4}{25}, \frac{1}{30}$	**62.** $\frac{4}{20}, \frac{3}{50}, \frac{7}{100}$

INDEX

ANSWERS TO

HAMILTON'S ESSENTIALS OF ARITHMETIC

MIDDLE GRADES

Page 14. — **13.** 64.   **14.** 64.   **15.** 53.   **16.** 57.   **17.** 74.   **18.** 52.   **19.** 60.   **20.** 2489.   **21.** 2243.   **22.** 2940.   **23.** 2554.   **24.** 2656.   **25.** 2735.   **26.** 9450.   **27.** 54,130.   **28.** 26,173.   **29.** 233,301.

Page 15. — **30.** 54,603   **31.** 20,427.   **32.** 7844.   **33.** 20,025.   **34.** 26,399.   **35.** $174.77.   **36.** $1345.11.   **37.** $1247.82.   **38.** $18,934.63.   **39.** $267.94.   **40.** $2120.46.   **41.** $741.57.   **42.** $505.25.   **43.** $33,195.20.   **44.** $13,039.49.   **45.** $15,116.85.   **46.** $10,790.17.

Page 17. — **1.** 775.   **2.** 686.   **3.** 375.   **4.** 626.   **5.** 784.   **6.** 500.   **7.** 501.   **8.** 205.   **9.** 275.   **10.** 54.   **11.** 672.   **12.** 587.   **13.** 285.   **14.** 200.   **15.** 875.   **16.** 371.   **17.** 625.   **18.** 186.   **19.** 269.   **20.** 344.   **21.** 9775.   **22.** 9686.   **23.** 9375.   **24.** 9626.   **25.** 9784.   **26.** 9500.   **27.** 9501   **28.** 9205.   **29.** 9275.   **30.** 9054.   **31.** 9672.   **32.** 9387.   **33.** 9285.   **34.** 9200.   **35** 9875.   **36.** 9371.   **37.** 9625.   **38.** 9186.   **39.** 9269.   **40.** 9344.   **41.** 158,219.   **42.** 357,511.   **43.** 349,197.   **44.** 81,485.   **45.** 51,008.   **46.** 133,003.   **47.** 701,898.   **48.** 171,951.   **49.** 107,803.   **50.** 16,909.   **51.** 62,062.   **52.** 5500.   **53.** $953.86.   **54.** $936.08.   **55.** $963.98.   **56.** $2959.96.   **57.** $17,062.83.   **58.** $309.16.   **59.** $6530.43.   **60.** 440,441   **61.** 373,068.   **62.** 346,229.   **63.** $1844.12.   **64.** $4833.22.   **65.** $5442.91.   **66.** $2856.17.   **67.** $2408.91.   **68.** $72,669.65.   **69.** $10,009.89.

Page 18. — **1.** $1.40.   **2.** $1.85.   **3.** $5.50.

Page 20. — **3.** 2835 bu.   **4.** 2523 ft.   **5.** 9890 doz.   **6.** $25,428   **7.** $25,198.   **8.** $13,195.   **9.** 59,073.   **10.** 83,895.   **11.** 47,192.   **12.** 2925.   **13.** 4368.   **14.** 3738.   **15.** 3900.   **16.** 1710.   **17.** 3015.   **18.** 3216.   **19.** 2278.   **20.** 9400.   **21.** 30,150.   **22.** 38,286.   **23.** 68,100.   **24.** 6104.   **25.** $266.49.   **26.** $273.   **27.** $244.67.   **28.** $672.75.   **29.** $4087.70.   **30.** $6644.40.   **31.** $6496.10.   **32.** $6678.12.   **33.** $5151.90.   **34.** $3131.22.   **35.** $1520.

Page 21. — **39.** 3,033,750.   **40.** 743,330.   **41.** 1,239,200.   **42.** 1,401,972.   **43.** 4,919,502.   **44.** 2,752,122.   **45.** 5,251,350.   **46.** 3,215,300.   **47.** 4,866,432.   **48.** 3,511,200.   **49.** 5,552,820.   **50.** 4,266,600.   **51.** 899,001.   **52.** 5,040,000.   **53.** 7,188,384.   **54.** 4,524,660.   **55.** 3,458,400.   **56.** 3,154,050.   **57.** 3,479,211.   **58.** 2,337,420.   **59.** 3,390,000.   **60.** 2,700,450.   **61.** 5,296,980.   **62.** 3,584,560.   **63.** 101,000   **64.** 250,700.   **65.** 5,664,708.

66. 3,354,000. **67.** 5,492,700. **68.** 7,488,832. **69.** *a.* 1,586,975;
b. 2,210,200; *c.* 3,623,700; *d.* 4,793,050; *e.* 5,165,700; *f.* 6,174,425;
g. 5,583,325; *h.* 5,114,300; *i.* 6,219,400; *j.* 5,769,650. **70.** *a.* 252,928;
b. 352,256; *c.* 577,536; *d.* 763,904; *e.* 823,296; *f.* 984,064; *g.* 889,856;
h. 815,104; *i.* 991,232; *j.* 919,552. **71.** *a.* 2,153,840; *b.* 2,999,680;
c. 4,918,080; *d.* 6,505,120; *e.* 7,010,880; *f.* 8,379,920; *g.* 7,577,680;
h. 6,941,120; *i.* 8,440,960; *j.* 7,830,560. **72.** *a.* 2,384,044; *b.* 3,320,288;
c. 5,443,728; *d.* 7,200,392; *e.* 7,760,208; *f.* 9,275,572; *g.* 8,387,588;
h. 7,682,992; *i.* 9,343,136; *j.* 8,667,496. **73.** *a.* 2,140,255; *b.* 2,980,760;
c. 4,887,060; *d.* 6,464,090; *e.* 6,966,660; *f.* 8,327,065; *g.* 7,529,885;
h. 6,897,340; *i.* 8,387,720; *j.* 7,781,170. **74.** *a.* 1,949,818; *b.* 2,715,536;
c. 4,452,216; *d.* 5,888,924; *e.* 6,346,776; *f.* 7,586,134; *g.* 6,859,886;
h. 6,283,624; *i.* 7,641,392; *j.* 7,088,812. **75.** *a.* 2,090,855; *b.* 2,911,960;
c. 4,774,260; *d.* 6,314,890; *e.* 6,805,860; *f.* 8,134,865; *g.* 7,356,085;
h. 6,738,140; *i.* 8,194,120; *j.* 7,601,570. **76.** *a.* 1,900,665; *b.* 2,647,080;
c. 4,389,980; *d.* 5,740,470; *e.* 6,186,780; *f.* 7,394,895; *g.* 6,686,955;
h. 6,125,220; *i.* 7,448,760; *j.* 6,910,110. **77.** *a.* 2,080,975; *b.* 2,898,200;
c. 4,751,700; *d.* 6,285,050; *e.* 6,773,700; *f.* 8,096,425; *g.* 7,321,325;
h. 6,706,300; *i.* 8,155,400; *j.* 7,565,650. **78.** *a.* 2,340,572; *b.* 3,259,744;
c. 5,344,464; *d.* 7,069,096; *e.* 7,618,704; *f.* 9,106,436; *g.* 8,234,644;
h. 7,542,896; *i.* 9,172,768; *j.* 8,509,448.

Page 23. — 2. 501. **3.** 201. **4.** 1574, r. 21. **5.** 745. **6.** 422,
r. 49. **7.** 2201. **8.** 1357. **9.** 13,938, r. 29. **10.** 12,583, r. 5.
11. 13,397, r. 20. **12.** 9564, r. 26. **13.** 5787, r. 37. **14.** 4494, r. 35.
15. 8185, r. 63. **16.** 6875. **17.** 5748, r. 57. **18.** 5868, r. 23.
19. 11,336. **20.** 6247, r. 35. **21.** 1608, r. 101. **22.** 2149, r. 120.

Page 24. — 23. $407. **24.** $409. **25.** $70, r. $226. **26.** $83,
r. $488. **27.** $152, r. $56. **28.** 6457, r. 16. **29.** 3181, r. 180.
30. 2768, r. 244. **31.** 3097, r. 26. **32.** 1425, r. 189. **33.** 1503, r. 405.
34. 1001, r. 222. **35.** 542, r. 167. **36.** 478, r. 401. **37.** 885, r. 95.
38. *a.* 24,120, r. 181; *b.* 18,260, r. 301; *c.* 9562, r. 429; *d.* 8528, r. 117;
e. 7473, r. 196; *f.* 6569, r. 445; *g.* 8193, r. 64; *h.* 7206, r. 559.
39. *a.* 29,278, r. 256; *b.* 22,165, r. 350; *c.* 11,607, r. 428; *d.* 10,351,
r. 702; *e.* 9071, r. 345; *f.* 7974, r. 344; *g.* 9945, r. 155; *h.* 8747, r. 701.
40. *a.* 21,882, r. 172; *b.* 16,566, r. 184; *c.* 8675, r. 248; *d.* 7736, r. 660;
e. 6779, r. 713; *f.* 5959, r. 892; *g.* 7432, r. 700; *h.* 6537, r. 859.
41. *a.* 32,258, r. 197; *b.* 24,421, r. 307; *c.* 12,788, r. 653; *d.* 11,405, r. 351;
e. 9994, r. 531; *f.* 8785, r. 901; *g.* 10,957, r. 268; *h.* 9638, r. 55.
42. *a.* 35,913, r. 188; *b.* 27,188, r. 320; *c.* 14,237, r. 660; *d.* 12,697,
r. 546; *e.* 11,127, r. 17; *f.* 9781, r. 368; *g.* 12,198, r. 650; *h.* 10,730, r. 62.
43. *a.* 29,045, r. 40; *b.* 21,988, r. 348; *c.* 11,514, r. 636; *d.* 10,269, r. 198;
e. 8998, r. 830; *f.* 7910, r. 660; *g.* 9865, r. 615; *h.* 8677, r. 831.
44. *a.* 25,411, r. 256; *b.* 19,238, r. 152; *c.* 10,074, r. 380; *d.* 8984, r. 532;
e. 7873, r. 259; *f.* 6921, r. 140; *g.* 8631, r. 545; *h.* 7592, r. 380.
45. *a.* 29,492, r. 169; *b.* 22,327, r. 267; *c.* 11,692, r. 233; *d.* 10,427,
r. 359; *e.* 9137, r. 520; *f.* 8032, r. 537; *g.* 10,017, r. 612; *h.* 8811, r. 558.

Page 25. — 1. $1.40. **2.** $6.60. **3.** $4,253,068.15; $2,668,751.33.
4. $2,787,244.92. **5.** $19.61; $12.30.

Page 27.—1. 26. **2.** 32. **3.** 18. **4.** 17. **5.** 29. **6.** 28.
7. 957. **8.** 702. **9.** 608. **10.** 918. **11.** 63. **12.** 49. **13.** 57.
14. 1656. **15.** 31. **16.** 44. **17.** 1443. **18.** 71. **19.** 2496. **20.** 64.

Page 31.—5. $\frac{3}{4}$; $\frac{5}{8}$; $\frac{7}{8}$. **6.** 1; $1\frac{1}{8}$. **7.** $1\frac{1}{4}$; 2; $2\frac{1}{4}$. **8.** $\frac{3}{8}$; $\frac{1}{4}$; $\frac{5}{8}$; $\frac{3}{4}$.
9. $6\frac{2}{3}$. **10.** $15\frac{3}{4}$. **11.** $16\frac{5}{8}$. **12.** $15\frac{5}{8}$. **13.** $17\frac{3}{8}$. **14.** $5\frac{1}{4}$; $15\frac{5}{8}$.
15. $31\frac{1}{4}$; 94. **16.** $2\frac{1}{4}$; $8\frac{1}{4}$. **17.** $6\frac{5}{8}$; $18\frac{5}{8}$. **18.** $24\frac{1}{4}$; $103\frac{1}{4}$. **19.** $1\frac{1}{4}$;
$18\frac{1}{4}$. **20.** $19\frac{3}{8}$; $36\frac{1}{4}$. **21.** $2\frac{3}{8}$; $51\frac{1}{4}$. **22.** 6; 13. **23.** $13\frac{1}{8}$; $25\frac{3}{8}$.
24. $9\frac{3}{8}$; $28\frac{1}{4}$. **25.** $1\frac{1}{4}$; $9\frac{1}{4}$. **26.** $20\frac{1}{4}$; $52\frac{7}{8}$. **27.** $20\frac{5}{8}$; $60\frac{7}{8}$. **28.** $6\frac{1}{4}$;
$11\frac{1}{4}$. **29.** $7\frac{3}{4}$. **30.** $73\frac{3}{4}$. **31.** $72\frac{7}{8}$. **32.** $33\frac{7}{8}$. **33.** $62\frac{3}{8}$. **34.** $\frac{3}{4}$ yd.
35. $1\frac{1}{8}$ yd. **36.** $\frac{1}{2}$ yd. **37.** $2\frac{1}{4}$ lb.

Page 33.—5. $\frac{2}{3}$. **6.** $\frac{7}{12}$. **7.** $3\frac{2}{3}$. **8.** $4\frac{3}{4}$. **9.** $\frac{1}{3}$. **10.** $\frac{5}{12}$.
11. $2\frac{1}{12}$. **12.** $1\frac{1}{3}$. **13.** $10\frac{7}{12}$; $6\frac{1}{4}$. **14.** $16\frac{3}{4}$; $3\frac{1}{12}$. **15.** $13\frac{1}{4}$; $2\frac{5}{12}$.
16. $18\frac{1}{12}$; $1\frac{1}{12}$. **17.** $23\frac{1}{4}$; $2\frac{5}{12}$.

Page 34.—18. $15\frac{5}{8}$; $7\frac{1}{8}$. **19.** $11\frac{7}{12}$; $1\frac{5}{12}$. **20.** $58\frac{5}{12}$; $25\frac{1}{4}$.
21. $28\frac{2}{3}$; $4\frac{1}{3}$. **22.** $21\frac{1}{12}$; $10\frac{1}{12}$. **23.** $1\frac{1}{2}$ doz.; 11 buttons. **24.** $5\frac{1}{4}$ hr.;
$2\frac{1}{3}$ hr. **25.** $2\frac{1}{4}$.

Page 36.—1. $5\frac{1}{4}$ in. **2.** $13\frac{2}{3}$ yd. **3.** $8\frac{3}{4}$ ft. **4.** $10\frac{1}{2}$ ft. **5.** 1 ft.
6. $1\frac{1}{4}$ yd. **7.** $1\frac{1}{2}$ ft. **8.** $5\frac{1}{4}$ ft.

1. $18\frac{3}{4}$. **2.** $13\frac{3}{4}$. **3.** $21\frac{3}{4}$. **4.** $18\frac{1}{4}$. **5.** $20\frac{1}{4}$. **6.** $61\frac{7}{8}$. **7.** $54\frac{1}{4}$.
8. $27\frac{5}{8}$. **9.** $100\frac{1}{4}$. **10.** $98\frac{1}{4}$. **11.** $12\frac{3}{8}$. **12.** $14\frac{7}{8}$. **13.** $15\frac{1}{4}$.
14. $155\frac{5}{12}$. **15.** $33\frac{1}{4}$.

Page 37.—16. $8\frac{1}{2}$. **17.** $12\frac{1}{12}$. **18.** $3\frac{1}{4}$. **19.** $3\frac{1}{4}$. **20.** $3\frac{1}{4}$.
21. $73\frac{1}{4}$. **22.** $9\frac{1}{4}$. **23.** $21\frac{1}{4}$. **24.** $2\frac{1}{2}$. **25.** $4\frac{1}{4}$. **26.** $64\frac{1}{12}$. **27.** $29\frac{1}{4}$.
28. $1\frac{3}{8}$. **29.** $29\frac{3}{8}$. **30.** $4\frac{1}{3}$. **31.** $41\frac{1}{4}$. **32.** $4\frac{5}{8}$. **33.** $9\frac{3}{4}$. **34.** $2\frac{1}{4}$.
35. $26\frac{1}{4}$.

Page 38.—1. $\$5\frac{8}{10}$. **2.** $\$16\frac{1}{2}$. **3.** $29\frac{7}{10}$ mi. **4.** $9\frac{4}{15}$.
5. $33\frac{7}{15}$ mi. **6.** $\$61\frac{5}{8}$. **7.** $90\frac{2}{15}$ da. **8.** $31\frac{7}{10}$ da. **9.** $\$1\frac{1}{10}$. **10.** $12\frac{2}{15}$ hr.
11. $\$4\frac{3}{10}$. **12.** $36\frac{8}{15}$ min. **13.** $5\frac{1}{3}$ hr.

Page 39.—14. $\frac{7}{10}$ hr.; 6 min. **15.** $\frac{1}{2}$ mi. **16.** $\$\frac{9}{10}$. **17.** $5\frac{4}{5}$
18. $6\frac{4}{5}$. **19.** $5\frac{9}{10}$. **20.** $12\frac{7}{10}$. **21.** $4\frac{1}{2}$. **22.** $7\frac{4}{15}$. **23.** $6\frac{4}{15}$. **24.** $6\frac{1}{10}$.
25. $3\frac{7}{10}$. **26.** $2\frac{1}{10}$. **27.** $1\frac{8}{10}$. **28.** $1\frac{4}{15}$.

Page 40.—1. $10\frac{13}{16}$ ft. **2.** $\$54\frac{5}{16}$. **3.** $37\frac{1}{16}$. **4.** $22\frac{7}{16}$. **5.** $\$4\frac{7}{16}$.
6. $5\frac{9}{16}$ yd. **7.** $4\frac{5}{16}$ mi. **8.** $16\frac{7}{16}$. **9.** $15\frac{1}{2}$ ft. **10.** 54 rd. **11.** $3\frac{1}{4}$ yd.
12. $2\frac{1}{16}$ in. **13.** $\$8\frac{1}{4}$.

Page 42.—1. $1\frac{1}{2}$; $1\frac{1}{2}$; $1\frac{1}{4}$; 2; $1\frac{1}{2}$; $1\frac{3}{8}$; $1\frac{3}{8}$; $1\frac{1}{15}$; $1\frac{1}{4}$. **2.** $106\frac{11}{12}$.
3. $98\frac{7}{12}$ ft. **4.** $43\frac{1}{4}$. **5.** $77\frac{7}{12}$ mi. **6.** $105\frac{1}{4}$. **7.** $50\frac{5}{12}$ doz. **8.** $24\frac{5}{8}$.
9. $35\frac{7}{12}$ da. **10.** $2\frac{1}{4}$. **11.** $2\frac{1}{4}$ ft. **12.** $2\frac{1}{4}$. **13.** $2\frac{7}{12}$ mi. **14.** $2\frac{7}{12}$.
15. $4\frac{1}{4}$ doz. **16.** $2\frac{1}{12}$. **17.** $10\frac{1}{4}$. **18.** $52\frac{1}{4}$ ft.; $1\frac{1}{2}$ ft. **19.** $14\frac{1}{6}$ in.
20. $18\frac{1}{4}$ hr. **21.** $\frac{1}{2}$ mi.; $5\frac{3}{4}$ mi.

Page 43.—1. $77\frac{7}{16}$ in. **2.** $83\frac{15}{16}$. **3.** $71\frac{9}{16}$. **4.** $89\frac{3}{16}$. **5.** $2\frac{7}{16}$ in.
6. $7\frac{1}{4}$ da. **7.** $15\frac{5}{16}$. **8.** $81\frac{5}{16}$.

Page 46.—7. $\frac{2}{4}$; $\frac{5}{12}$; $\frac{2}{7}$; $\frac{2}{8}$; $\frac{1}{2}$; $\frac{7}{8}$; $\frac{3}{8}$; $\frac{1}{3}$; $\frac{21}{25}$; $\frac{4}{7}$; $\frac{1}{2}$; $\frac{25}{61}$. **8.** $\frac{9}{8}$; $\frac{6}{7}$;
$\frac{9}{11}$; $\frac{6}{7}$; $\frac{3}{4}$; $\frac{2}{3}$. **9.** $\frac{5}{12}$; $\frac{9}{14}$; $\frac{9}{10}$; $\frac{1}{2}$; $\frac{13}{18}$; $\frac{10}{11}$. **10.** $\frac{4}{8}$; $\frac{7}{7}$; $\frac{4}{8}$; $\frac{5}{8}$; $\frac{9}{11}$; $\frac{14}{11}$.

Page 48. — 2. $\frac{47}{5}$.   3. $\frac{71}{4}$.   4. $1\frac{13}{6}$.   5. $1\frac{60}{7}$.   6. $2\frac{47}{8}$.   7. $\frac{385}{9}$.
8. $\frac{563}{11}$.   9. $\frac{725}{8}$.   10. $\frac{453}{10}$.   11. $\frac{793}{14}$.   12. $1\frac{131}{16}$.   13. $\frac{409}{16}$.
14. $\frac{1365}{16}$.   15. $\frac{739}{8}$.   16. $\frac{1027}{16}$.   17. $\frac{979}{16}$.   18. $1\frac{251}{16}$.   19. $\frac{4011}{50}$.
20. $1\frac{081}{25}$.   21. $1\frac{072}{15}$.   22. $\frac{671}{8}$.   23. $1\frac{817}{20}$.   24. $\frac{722}{25}$.   25. $\frac{883}{8}$.

Page 50. — 2. $\frac{15}{24}$; $\frac{16}{24}$.   3. $\frac{9}{12}$; $\frac{10}{12}$.   4. $\frac{10}{18}$; $\frac{5}{18}$.   5. $\frac{8}{12}$; $\frac{9}{12}$.
6. $\frac{20}{24}$; $\frac{9}{24}$.   7. $\frac{9}{10}$; $\frac{6}{10}$.   8. $\frac{6}{12}$; $\frac{4}{12}$; $\frac{3}{12}$.   9. $\frac{2}{12}$; $\frac{8}{12}$; $\frac{9}{12}$.   10. $\frac{20}{40}$;
$\frac{15}{40}$; $\frac{32}{40}$.   11. $\frac{105}{140}$; $\frac{56}{140}$; $\frac{60}{140}$.   12. $\frac{315}{360}$; $\frac{80}{360}$; $\frac{108}{360}$.   13. $\frac{25}{60}$; $\frac{48}{60}$; $\frac{40}{60}$.
14. $\frac{45}{80}$; $\frac{28}{80}$; $\frac{20}{80}$.   15. $\frac{20}{35}$; $\frac{15}{35}$; $\frac{12}{35}$.   16. $\frac{30}{35}$; $\frac{18}{35}$; $\frac{15}{35}$.   17. $\frac{7}{10}$; $\frac{6}{10}$;
$\frac{5}{10}$.   18. $\frac{10}{32}$; $\frac{28}{32}$; $\frac{9}{32}$.   19. $\frac{7}{15}$; $\frac{12}{15}$; $\frac{6}{15}$.   20. $\frac{10}{24}$; $\frac{15}{24}$; $\frac{18}{24}$.   21. $\frac{3}{12}$;
$\frac{8}{12}$.   22. $\frac{7}{20}$; $\frac{10}{20}$; $\frac{12}{20}$.   23. $\frac{72}{84}$; $\frac{63}{84}$; $\frac{28}{84}$.   24. $\frac{112}{126}$; $\frac{18}{126}$; $\frac{8}{126}$.
25. $\frac{175}{210}$; $\frac{120}{210}$; $\frac{42}{210}$.

Page 52. — 2. $1\frac{19}{36}$.   3. $1\frac{11}{72}$.   4. $1\frac{24}{35}$.   5. $1\frac{5}{72}$.   6. $\frac{29}{30}$.   7. $1\frac{11}{40}$.
8. $1\frac{5}{8}$.   9. $1\frac{1}{10}$.   10. $1\frac{19}{30}$.   11. $1\frac{3}{16}$.   12. $\frac{31}{44}$.   13. $\frac{19}{30}$.   14. 1.
15. $2\frac{3}{20}$.   16. $1\frac{11}{12}$.   17. $2\frac{5}{16}$.   18. $1\frac{7}{24}$.   19. $2\frac{1}{16}$.   20. $1\frac{43}{48}$.
21. $2\frac{23}{60}$.   22. $2\frac{7}{120}$.   23. $1\frac{17}{40}$.   24. $1\frac{17}{20}$.   25. $2\frac{7}{18}$.   26. $2\frac{7}{24}$.
27. $2\frac{9}{35}$.   28. $1\frac{31}{84}$.   29. $1\frac{19}{90}$.   30. $2\frac{11}{72}$.   31. $2\frac{37}{60}$.   32. $1\frac{1}{20}$.
33. $1\frac{9}{16}$.   34. $\frac{352}{504}$.   35. $1\frac{25}{48}$.   36. $1\frac{19}{40}$.   37. $1\frac{1}{3}$.

Page 53. — 2. $16\frac{1}{3}$.   3. $219\frac{3}{8}$.   4. $99\frac{1}{4}$.   5. $92\frac{11}{12}$.   6. 192.
7. $618\frac{1}{8}$.   8. $382\frac{5}{16}$.   9. $257\frac{7}{15}$.   10. $92\frac{11}{24}$.   11. $5\frac{87}{120}$.   12. $29\frac{5}{8}$.
13. $17\frac{13}{30}$.   14. $18\frac{17}{30}$.   15. $32\frac{7}{30}$.   16. $6\frac{17}{48}$.   17. $9\frac{5}{8}$.   18. $19\frac{29}{45}$.
19. $18\frac{1}{24}$.   20. $6\frac{43}{36}$.   21. $8\frac{5}{8}$ mi.   22. \$ $67\frac{1}{20}$.   23. \$ 56.

Page 54. — 24. $12\frac{1}{4}$ yd.   25. $28\frac{3}{4}$ in.   26. $485\frac{1}{2}$ qt.   27. \$ $35\frac{3}{20}$.
28. \$ $23\frac{1}{20}$.   29. $386\frac{3}{15}$ lb.   30. $253\frac{1}{4}$ yd.   31. $159\frac{11}{15}$ ft.   32. $100\frac{1}{3}$ ft.
33. $1409\frac{1}{40}$ mi.

Page 55. — 34. 22 bu.   35. $\frac{13}{20}$.   36. \$ $1\frac{1}{2}$.   37. $5\frac{1}{2}$ ft.   38. \$ $4\frac{3}{20}$.
39. \$ $2\frac{2}{3}$.   40. $8\frac{1}{4}$ yd.   41. $12\frac{1}{20}$ in.   42. $29\frac{1}{8}$ mi.   43. \$ $30\frac{7}{10}$.
44. $6\frac{15}{16}$ yd.

Page 57. — 2. $\frac{5}{12}$.   3. $\frac{3}{8}$.   4. $\frac{1}{6}$.   5. $\frac{3}{10}$.   6. $\frac{5}{12}$.   7. $\frac{3}{16}$.
8. $\frac{1}{4}$.   9. $\frac{1}{6}$.   10. $\frac{1}{3}$.   11. $\frac{1}{16}$.   12. $\frac{2}{15}$.   13. $\frac{1}{6}$.   14. $\frac{1}{8}$.   15. $\frac{9}{16}$.
16. $\frac{1}{4}$.   17. $\frac{9}{16}$.   18. $\frac{7}{30}$.   19. $\frac{1}{12}$.   20. $\frac{7}{15}$.   21. $\frac{1}{4}$.   22. $\frac{3}{16}$.
23. $\frac{1}{3}$ yd.   24. $\frac{7}{10}$ mi.   25. $1\frac{3}{8}$ yd.

Page 58. — 27. $2\frac{1}{3}$.   28. $11\frac{1}{4}$.   29. $21\frac{1}{12}$.   30. $6\frac{2}{3}$.   31. $32\frac{1}{9}$.
32. $43\frac{23}{24}$.   33. $17\frac{1}{4}$.   34. $8\frac{1}{4}$.   35. $2\frac{3}{7}$.   36. $9\frac{1}{10}$.   37. $17\frac{7}{15}$.   38. $27\frac{3}{17}$.
39. $54\frac{3}{16}$.   40. $3\frac{7}{20}$.   41. $24\frac{1}{3}$.   42. $9\frac{1}{2}$.   43. $10\frac{1}{4}$.   44. $39\frac{1}{4}$.
45. $6\frac{3}{11}$.   46. $50\frac{3}{10}$.   47. $47\frac{1}{8}$.   48. \$ $1\frac{1}{4}$.   49. $7\frac{1}{8}$ gal.   50. $9\frac{1}{4}$ bu
52. $1\frac{1}{4}$.   53. $3\frac{1}{16}$.   54. $7\frac{1}{8}$.   55. $8\frac{1}{8}$.   56. $7\frac{1}{8}$.   57. $13\frac{3}{10}$.   58. $13\frac{1}{12}$.
59. $53\frac{3}{16}$.   60. $62\frac{2}{25}$.   61. $55\frac{7}{20}$.   62. $66\frac{1}{8}$.   63. $66\frac{5}{8}$.   64. $15\frac{1}{16}$.
65. $13\frac{7}{36}$.   66. $48\frac{4}{21}$.   67. $43\frac{1}{15}$.   68. $10\frac{7}{15}$.   69. $12\frac{4}{33}$.   70. $40\frac{8}{15}$.
71. $7\frac{3}{8}$.   72. $102\frac{3}{8}$.

Page 59. — 74. $1\frac{5}{6}$.   75. $2\frac{1}{4}$.   76. $2\frac{17}{24}$.   77. $4\frac{5}{8}$.   78. $6\frac{1}{4}$.
79. $19\frac{13}{16}$.   80. $4\frac{8}{35}$.   81. $5\frac{14}{15}$.   82. $32\frac{1}{4}$.   83. $25\frac{7}{15}$.   84. $66\frac{41}{42}$.
85. $9\frac{9}{10}$.   86. $1\frac{11}{15}$ hr.   87. \$ $6\frac{3}{4}$.   88. $\frac{7}{20}$ mi.   89. \$ $2\frac{13}{20}$.   90. $\frac{3}{4}$ ft
91. $7\frac{3}{4}$ ft.   92. $8\frac{1}{4}$ gal.   93. \$ $44\frac{13}{20}$.

Page 60. — 1. $\frac{7}{12}$. **2.** $4\frac{1}{2}$. **3.** $5\frac{3}{4}$. **4.** $1\frac{7}{8}$. **5.** $8\frac{9}{10}$. **6.** $9\frac{17}{18}$.
7. $1\frac{7}{18}$. **8.** $17\frac{43}{48}$. **9.** $\frac{5}{8}$. **10.** $15\frac{1}{4}$. **11.** $16\frac{8}{15}$. **12.** $131\frac{1}{16}$. **13.** $9\frac{17}{32}$.
14. $23\frac{19}{36}$. **15.** $5\frac{29}{48}$. **16.** $8\frac{2}{3}$. **17.** $74\frac{21}{40}$. **18.** $438\frac{77}{120}$. **19.** $4\frac{2}{21}$.
20. $44\frac{109}{120}$. **21.** $2\frac{1}{4}$. **22.** $258. **23.** $354\frac{4}{5}$. **24.** $418.50. **25.** $\frac{4}{5}$ da.
26. 201 rd.

Page 61. — 27. $7\frac{7}{10}$ bu. **28.** $7\frac{1}{4}$ hr. **29.** $13\frac{13}{20}$. **30.** $1\frac{1}{3}$ yd.
31. $1\frac{3}{4}$ hr. **32.** $3\frac{7}{10}$ T. **33.** $2\frac{5}{8}$ lb. **34.** $8\frac{3}{8}$ A. **35.** $\frac{11}{20}$. **36.** $424\frac{1}{2}$ gal.
37. $610\frac{9}{16}$ mi.

Page 62. — 38. $243\frac{3}{4}$ lb. **39.** $43\frac{9}{20}$ hr. ; $28\frac{11}{20}$ hr. **40.** $2\frac{13}{24}$ mi. ; $1\frac{5}{24}$ mi.
41. 84 yd. ; $9\frac{1}{3}$ yd. **44.** $10\frac{3}{4}$ in. ; $\frac{1}{10}$ in. ; $2\frac{1}{10}$ in. **45.** $\frac{1}{8}$ lb. ; $\frac{3}{16}$ lb. ; $\frac{1}{4}$ lb. ;
$\frac{1}{3}$ lb. ; $1\frac{1}{16}$ lb.

Page 63. — 47. $7\frac{3}{8}$ T. **48.** $20\frac{15}{16}$ in. **49.** $2\frac{1}{8}$ in. ; $3\frac{5}{16}$ in. **50.** $4\frac{2}{3}$ ft. ;
$3\frac{5}{8}$ ft. , $1\frac{1}{2}$ ft. **51.** $11\frac{1}{4}$ hr. **52.** $2\frac{9}{20}$ sec. **53.** $70\frac{1}{2}$ lb. ; $98\frac{1}{4}$ lb. ; $168\frac{5}{8}$ lb. ;
$27\frac{1}{4}$ lb. **54.** Paul, $\frac{1}{8}$ in. ; Susan, $\frac{7}{16}$ in.

Page 64. — 55. $14\frac{1}{20}$ hr. **56.** $4\frac{1}{3}$ yd. **57.** $22\frac{3}{4}$ yr. **58.** $2\frac{1}{4}$ ft.
59. $6\frac{11}{16}$ yd. **60.** $3\frac{5}{16}$ mi. Addition : **61.** $6\frac{17}{40}$; $7\frac{11}{20}$; $11\frac{7}{15}$; $8\frac{3}{10}$; $10\frac{11}{20}$;
$12\frac{7}{15}$. **62.** $10\frac{43}{72}$; $9\frac{37}{72}$; $9\frac{17}{72}$; $12\frac{59}{72}$; $14\frac{7}{24}$; $13\frac{5}{8}$. **63.** $20\frac{1}{10}$; 21 ; $23\frac{31}{40}$; $30\frac{43}{80}$;
$40\frac{49}{80}$; $34\frac{13}{40}$. **64.** $49\frac{7}{8}$; $54\frac{7}{16}$; $58\frac{3}{20}$; $23\frac{11}{20}$; $69\frac{7}{8}$; $74\frac{31}{40}$. **65.** $83\frac{3}{10}$; $88\frac{17}{40}$;
$67\frac{23}{80}$; $85\frac{19}{40}$; $76\frac{53}{90}$; $106\frac{51}{110}$. Subtraction : **61.** $\frac{23}{40}$; $1\frac{19}{20}$; $5\frac{13}{15}$; $2\frac{7}{10}$; $4\frac{13}{20}$;
$8\frac{13}{15}$. **62.** $1\frac{61}{72}$; $\frac{51}{56}$; $\frac{23}{24}$; $4\frac{5}{72}$; $5\frac{7}{24}$; $4\frac{7}{9}$. **63.** $3\frac{1}{2}$; $4\frac{4}{5}$; $7\frac{13}{40}$; $14\frac{7}{60}$; $24\frac{7}{80}$;
$17\frac{7}{80}$. **64.** $31\frac{5}{8}$; $35\frac{15}{16}$; $39\frac{13}{20}$; $5\frac{7}{20}$; $51\frac{5}{8}$; $56\frac{7}{60}$. **65.** $67\frac{7}{10}$; $72\frac{8}{45}$; $51\frac{7}{80}$;
$69\frac{11}{40}$; $60\frac{41}{50}$; $90\frac{29}{110}$.

Page 65. — 1. $9\frac{3}{20}$. **2.** $6\frac{7}{10}$. **3.** $46\frac{9}{10}$. **4.** $13\frac{13}{14}$. **5.** $11\frac{11}{24}$.
6. $113\frac{53}{60}$. **7.** $8\frac{5}{8}$. **8.** $8\frac{42}{55}$. **9.** $89\frac{1}{8}$. **10.** $12\frac{1}{4}$. **11.** $28\frac{7}{12}$. **12.** $113\frac{31}{48}$.
13. $9\frac{23}{56}$. **14.** $10\frac{3}{4}$. **15.** $10\frac{7}{15}$. **16.** $10\frac{1}{4}$. **17.** $44\frac{9}{16}$. **18.** $28\frac{11}{40}$.
19. $18\frac{5}{8}$. **20.** $15\frac{1}{4}$. **21.** $6\frac{1}{4}$. **22.** $5\frac{37}{56}$. **23.** $20\frac{11}{14}$. **24.** $8\frac{7}{16}$.
25. $7\frac{1}{4}$.

Page 68. — 1. $1\frac{3}{4}$. **2.** 35 ¢. **3.** $.96. **4.** $2\frac{1}{2}$. **5.** 28 mi.
6. $927. **7.** 1000 A. ; 500 A. **8.** 292 da. **9.** $240. **10.** $5460.
11. 9200 girls ; 5520 boys. **12.** $30. **13.** $648. **14.** $7600.

Page 71. — 3. 45. **4.** 138. **5.** 326. **6.** 4805. **7.** 10,805.
8. 1100. **9.** 3927. **10.** 6006. **11.** 4284. **12.** 1704. **13.** 9729.
14. 15,606. **15.** 9004. **16.** 3241. **17.** 36. **18.** 45. **19.** 24.
20. 45. **21.** 36. **22.** 32. **23.** 102.

Page 72. — 24. 51. **25.** 18. **26.** $26\frac{2}{3}$. **27.** $43\frac{1}{3}$. **28.** 108.
29. $579\frac{3}{8}$. **30.** 2685. **31.** 1826. **32.** $614\frac{2}{3}$. **33.** 1320. **34.** 345.
35. $2343\frac{3}{4}$. **36.** $1779\frac{3}{8}$. **37.** 1470. **38.** $733\frac{1}{3}$. **39.** $1756\frac{4}{11}$. **40.** $368\frac{5}{8}$.
41. 1425. **42.** $812\frac{1}{2}$. **43.** 3030. **44.** 2005. **45.** 2315. **46.** 2499.
47. 3027. **48.** 8165. **49.** 15,005. **50.** 114. **51.** 144. **52.** 249.
53. 645. **54.** 3996. **55.** 2012. **56.** 14,955. **57.** 2092. **58.** 6276.
59. 5615. **60.** 2476. **61.** 4900. **62.** 470. **63.** 208. **64.** 7990.
65. 4104. **66.** 348. **67.** 1020. **68.** 5971. **69.** 196. **70.** 357.
71. 1687. **72.** $150. **73.** $525. **74.** $3.75 ; $2.25. **75.** $3.

Page 73. — 76. $24.75. **77.** $20.18. **78.** $3.45. **79.** $3.88.
80. $1.58. **81.** 145 mi. **82.** 438 mi. **83.** $1. **84.** $2.04.
85. 95 ¢. **86.** $3. **87.** $4.99. **88.** $12.57. **89.** $553\frac{1}{2}$ mi.
90. $2.65.

Page 74.—13. 25/72. 14. 32/63. 15. 16/45. 16. 15/64. 17. 20/33. 18. 21/44.
19. 16/21. 20. 32/45. 21. 20/63. 22. 5/22. 23. 12/49. 24. 27/50. 26. 4 1/6.
27. 8 4/5. 28. 4 1/2. 29. 10 5/6. 30. 2 1/32. 31. 5 5/8. 32. 33 5/20. 33. 120 5/6.
34. 60 15/16. 35. 52 1/2. 36. 33 1/4. 37. 156 1/4.

Page 75.—3. 2 6/7. 4. 9 3/8. 5. 12. 6. 10 1/2. 7. 1 1/2. 8. 71 1/2.
9. 105. 10. 49. 11. 3 1/4. 12. 85. 13. 33 3/4. 14. 37 1/2. 15. 54.
16. 199 4/5. 17. $144. 18. 15 min. 19. 354 4/5 mi. 20. $45 3/20.

Page 76.—1. 17 1/2 tablespoonfuls. 2. $1136 7/8. 3. 682 1/2 lb.
4. $14,892 1/2. 5. 115 hr.; 517 1/2 hr. 6. 500 mi. 7. $1685. 8. $1.24.
9. $83.50. 10. 7401 1/4 mi. 11. 1409 13/16 T.

Page 79.—3. 78. 4. 7/32. 5. 50. 6. 3 1/3. 7. 4 1/2. 8. 2. 9. 72.
10. 72. 11. 20. 12. 20. 13. 2 1/2. 14. 2 1/4. 15. 24. 16. 4.
17. 7 1/2. 18. 27. 19. 40. 20. 7/40. 21. 40. 22. 72. 23. 81.
24. 100. 25. 117. 26. 300. 27. 640. 28. 304. 29. 800. 30. 10.

Page 80.—31. 12. 32. 9. 33. 10. 34. 16. 35. 16. 36. 20.
37. 27. 38. 24. 39. 40. 40. 45. 41. 100. 42. 40. 43. 45.
44. 204. 45. 63. 46. 5. 47. 4. 48. 3. 49. 4. 50. 6 3/4. 51. 2.
52. 5. 53. 1 3/10. 54. 1 22/88. 55. 4 9/58. 56. 1/2. 57. 1 1/11. 58. 1 3/8.
59. 2 13/21. 60. 1 1/3. 61. 3 3/5. 62. 3 3/5. 63. 4 4/5. 64. 3 1/5. 65. 4 1/3.
66. 3 1/4. 67. 4 1/5. 68. 5 5/8. 69. 2 1/4. 70. 32 ¢. 71. 10 dresses.
72. 30 badges. 73. 12 ¢. 74. 12 hats. 75. $3. 76. 10 ¢.

Page 81.—1. 2 1/2 ft.; 30 in. 2. 2112 steps. 3. $625.60. 4. 1 min.
51 1/10 sec. 5. 3 2/3 hr. 6. 45 sq. ft.; 60 sq. ft.; 39 1/8 sq. ft. 7. $16.08.

Page 82.—1. $3.19; $.13 7/24. 2. 9 1/8 mi. 3. $569.60. 4. a. 24 da.;
b. $.02. 5. 1 1/4 hr.

Page 84.—Set I: 1. 1 3/5. 2. 1/25. 3. 4. 4. 32. 5. $6.
Set II: 1. 9 5/16. 2. 1 1/16. 3. 1 3/4. 4. 1600. 5. $7. Set III: 1. 102 48/49.
2. 7 9/10. 3. 31 1/4. 4. 40. 5. $4. Set IV: 1. 49 5/8. 2. 18 9/16.
3. 384. 4. 20. 5. $1. Set V: 1. 69 11/12. 2. 1 1/2. 3. 1 2/8. 4. 1 3/4.
5. $.87 1/2. Set VI: 1. 2 1/2. 2. 1 5/12. 3. 6 3/80. 4. 720. 5. 3.
Set VII: 1. 1 9/32. 2. 40. 3. 31 1/8. 4. 800. 5. 36. Set VIII:
1. 1 13/32. 2. 34 1/10. 3. 108 48/49. 4. 256. 5. 9.

Page 85.—1. 182,501. 2. 166,326. 3. 234,136. 4. 291,438.

Page 86.—5. 364,888. 6. 322,279. 7. 385,851. 8. 464,647.
9. $639.51. 10. $298.18. 11. $230.10. 12. $213.14. 13. $297.04.
14. $177.58. 15. $264.37. 16. $220.38. 17. $342.95. 18. $316.01.
19. $4155.82. 20. $16,381.63.

Page 87.—1. a. 15; b. 353; c. 478; d. 118; e. 105; f. 55.
2. a. 6507; b. 211; c. 3299; d. 98; e. 1672; f. 4858. 3. a. 1163;
b. 1373; c. 454; d. 1535; e. 573; f. 1224. 4. a. 159; b. 1425; c. 2216;
d. 1126; e. 202; f. 485.

Page 88.—5. a. 10,273; b. 16.008; c. 20,444; d. 11,179.
6. a. 79.857; b. 168.876; c. 175.892; d. 23.353. 7. a. $242.68;
b. $828.14; c. $2.733; d. $21. 8. a. $213.66; b. $229.09; c. $8.01;
d. $2066.32. 9. a. $324.89; b. $1809.59; c. $93.89; d. $125.102.
10. a. $1141.09; b. $1519.21; c. $7158.89; d. $293.744.

11. *a.* $1619.71; *b.* $201.92; *c.* $679.18; *d.* $365.91. **12.** *a.* $3520.62, *b.* $2341.02; *c.* $7135.35; *d.* $6021.52. **13.** *a.* $2151.02; *b.* $2143.71; *c.* $739.42; *d.* $1071.46. **14.** *a.* $149.25; *b.* $6216.68; *c.* $1134.76; *d.* $2219.14. **15.** *a.* $90.11; *b.* $2231.27; *c.* $7069.82; *d.* $3320.13.

Page 89. — **1.** 800. **2.** 400. **3.** 945. **4.** 1833. **5.** 5628. **6.** 4116. **7.** 782. **8.** 4256. **9.** 3060. **10.** 22,050. **11.** 20,672. **12.** 10,300. **13.** 32,400. **14.** 36,216. **15.** 29,000. **16.** 34,476. **17.** 34,650. **18.** 2040. **19.** 2100. **20.** 3283. **21.** 3286. **22.** 6370. **23.** 3600. **24.** 98,901. **25.** 16,800. **26.** 37,500. **27.** 24,000. **28.** 26,780. **29.** 105,000. **30.** 550. **31.** 600. **32.** 800. **33.** 855. **34.** 630. **35.** 499,824. **36.** 501,125. **37.** 1,960,980. **38.** 1,588,968. **39.** 2,263,527. **40.** 3,295,072. **41.** 1,440,285. **42.** 9,259,888. **43.** 2,796,430. **44.** 7,351,680. **45.** 3,662,650. **46.** 2,178,583. **47.** 4,802,880. **48.** 808,202. **49.** 495,110. **50.** 7,223,760. **51.** 5,646,207.

Page 90. — **1.** 475. **2.** 112, r. 20. **3.** 106, r. 29. **4.** 280, r. 23. **5.** 51, r. 79. **6.** 124, r. 46. **7.** 103, r. 34. **8.** 23,391, r. 15. **9.** 6383, r. 30. **10.** 491, r. 12. **11.** 11,865, r. 36. **12.** 1557, r. 9. **13.** 16,626, r. 14. **14.** 1044, r. 24. **15.** 348, r. 16. **16.** 23,425, r. 2. **17.** 51,305. **18.** 1902, r. 48. **19.** 6535, r. 48. **20.** 7075. **21.** 8534, r. 66. **22.** 10,315, r. 9. **23.** 2339, r. 7. **24.** 5061, r. 7. **25.** 29,674, r. 9. **26.** 23,606, r. 20. **27.** 248. **28.** 23,658, r. 8. **29.** 2035. **30.** 1642, r. 20. **31** 3020. **32.** 3655. **33.** 1052, r. 9. **34.** 10,100. **35.** 1420. **36.** 204. **37.** 90, r. 45. **38.** 2080, r. 81. **39.** 1932, r. 6. **40.** 21, r. 5. **41.** 101, r. 240. **42.** 90, r. 400. **43.** 139, r. 543. **44.** 87, r. 403. **45.** 84, r. 143. **46.** 73, r. 448. **47.** 125, r. 75. **48.** 57, r. 417. **49.** 388, r. 118. **50.** 28, r. 899. **51.** 96, r. 94. **52.** 976, r. 301. **53.** 80, r. 150. **54.** 500, r. 47.

Page 92. — **1.** 4000 packages. **2.** 32,000 oz. **3.** $1\frac{1}{2}$ T.; $21. **4.** $51\frac{3}{4}$ bu. **5.** 4600 packages. **6.** $1093\frac{1}{3}$ yd. **7.** 755,040 ft. **8.** 60 ft.; $6. **9.** 42 lb. **10.** $83.50. **11.** $277\frac{1}{2}$ ft. **12.** 339 bu. 1 pk.

Page 94. — **49.** $\frac{6}{8}$; $\frac{4}{8}$; $\frac{3}{8}$. **50.** $\frac{15}{20}$; $\frac{18}{20}$; $\frac{8}{20}$. **51.** $\frac{20}{60}$; $\frac{45}{60}$; $\frac{18}{60}$. **52.** $\frac{60}{90}$; $\frac{20}{90}$; $\frac{27}{90}$. **53.** $\frac{11}{18}$; $\frac{10}{18}$; $\frac{3}{16}$. **54.** $\frac{6}{12}$; $\frac{8}{12}$; $\frac{9}{12}$. **55.** $\frac{16}{24}$; $\frac{6}{24}$; $\frac{21}{24}$. **56.** $\frac{9}{80}$; $\frac{24}{80}$; $\frac{20}{80}$.

Page 95. — **35.** $54\frac{11}{18}$. **36.** $214\frac{7}{8}$. **37.** $63\frac{5}{8}$. **38.** $204\frac{13}{55}$. **39.** $150\frac{1}{24}$. **40.** $281\frac{47}{120}$. **41.** $213\frac{43}{48}$. **42.** $267\frac{1}{2}$. **43.** $8\frac{3}{4}$. **44.** $61\frac{2}{5}$. **45.** $23\frac{7}{18}$. **46.** $13\frac{5}{12}$. **47.** $24\frac{5}{8}$. **48.** $14\frac{7}{12}$. **49.** $59\frac{5}{12}$. **50.** $22\frac{11}{12}$. **51.** $10\frac{11}{24}$. **52.** $35\frac{5}{24}$. **53.** $7\frac{23}{24}$. **54.** $16\frac{9}{28}$. **55.** $55\frac{11}{28}$. **56.** $4\frac{4}{9}$. **57.** $11\frac{7}{18}$. **58.** $14\frac{11}{30}$. **59.** $42\frac{1}{2}$. **60.** $29\frac{5}{8}$. **61.** $36\frac{17}{24}$. **62.** $59\frac{4}{15}$. **63.** $\frac{27}{40}$; $\frac{8}{40}$. **64.** $\frac{67}{90}$; $\frac{18}{90}$. **65.** $2\frac{7}{12}$; $1\frac{1}{12}$. **66.** $1\frac{5}{16}$; $\frac{7}{16}$. **67.** $2\frac{1}{12}$; $2\frac{5}{12}$. **68.** $1\frac{7}{16}$; $\frac{11}{16}$.

Page 96. — **69.** $1\frac{5}{12}$; $\frac{7}{12}$. **70.** $2\frac{7}{12}$; $\frac{7}{12}$. **71.** $2\frac{1}{4}$; $1\frac{5}{12}$. **72.** $5\frac{7}{8}$; $\frac{5}{8}$. **73.** $9\frac{11}{24}$; $\frac{19}{24}$. **74.** $2\frac{1}{55}$; $\frac{15}{55}$. **75.** $3\frac{17}{44}$. **76.** $8\frac{25}{48}$. **77.** $3\frac{1}{48}$. **78.** $2\frac{8}{15}$. **79.** $9\frac{4}{15}$. **80.** $8\frac{31}{48}$. **81.** $9\frac{31}{48}$. **82.** $4\frac{7}{48}$. **83.** $2\frac{61}{120}$. **84.** $2\frac{7}{12}$. **85.** $\frac{13}{24}$. **86.** $8\frac{53}{144}$. **87.** $4\frac{7}{8}$. **88.** $24\frac{7}{48}$. **89.** $6\frac{5}{8}$. **90.** $12\frac{71}{80}$. **91.** $10\frac{5}{56}$. **92.** $6\frac{102}{180}$. **93.** $16\frac{1}{4}$. **94.** $7\frac{13}{48}$. **95.** $1\frac{23}{120}$. **96.** $10\frac{51}{84}$.

Page 97. — **2.** 6. **3.** 21. **4.** 18. **5.** 20. **6.** 60. **7.** 44. **8.** $9\frac{1}{4}$. **9.** $12\frac{5}{8}$. **10.** $38\frac{2}{7}$. **11.** $3\frac{1}{2}$. **12.** $13\frac{1}{3}$. **13.** $4\frac{4}{9}$. **14.** $4\frac{4}{5}$. **15.** 26. **16.** 63. **17.** $5\frac{5}{8}$. **18.** $20\frac{5}{6}$. **19.** 35. **20.** 48. **21.** 28. **22.** $\frac{1}{2}$. **23.** $\frac{1}{5}$. **24.** $\frac{9}{14}$. **25.** $\frac{4}{7}$. **26.** $\frac{1}{4}$. **27.** $\frac{1}{3}$. **28.** $\frac{2}{3}$. **29.** $\frac{2}{3}$. **30.** $\frac{1}{3}$. **31.** $\frac{10}{13}$. **32.** $\frac{1}{3}$. **33.** $\frac{7}{17}$. **34.** $\frac{27}{32}$.

35. ⅖. **36.** 14/25. **37.** 20¼. **38.** 44. **39.** 96¾. **40.** 94⅘. **41.** 49½. **42.** 59¼.
43. 24⅖. **44.** 150⅔. **45.** 198⁶. **46.** 234⅖. **47.** 327¾. **48.** 158½.
49. 134⅖. **50.** 256½. **51.** 339½.

Page 98. — **53.** 2¼. **54.** 2. **55.** 2⁷⁄₉. **56.** ⅝. **57.** 1½. **58.** 1 3/16.
59. 1 1/14. **60.** 15/64. **61.** 3/10. **62.** 2/9. **63.** ¾. **64.** ⅛. **65.** 609/1000.
66. 27/70. **67.** 1 7/20. **68.** 1 46/125. **69.** 999/4096. **70.** 6½. **71.** 103 59/?.
72. 1 109/320. **73.** 9/160. **74.** 25/64. **75.** 4/25. **76.** 3/32. **77.** 9¾. **78.** 3¼.
79. ⅛. **80.** 1/15. **81.** 1/30. **82.** 1/160. **83.** 63/800. **84.** 1/15. **85.** 5/24.
86. ⅝. **87.** 1/16. **88.** ⅛. **89.** 1/64. **90.** 9/128. **91.** 18 9/16. **92.** 7/20.
93. 126 1/24. **94.** 44⅝. **95.** 2¼. **96.** 1⅘.

Page 99. — **1.** 12. **2.** 1⅘. **3.** 6⅔. **4.** 1 5/16. **5.** 1½. **6.** 29/40.
7. 1⅔. **8.** 15/128. **9.** 6/35. **10.** 11/72. **11.** 3/35. **12.** 3/32. **13.** 1⅘.
14. 2 19/96. **15.** 1 17/36. **16.** 1 1/14. **17.** ¾. **18.** 1 47/57. **19.** 1 13/28. **20.** 1 7/22.
21. 2⅗. **22.** 1⅘. **23.** 9½. **24.** 8¼. **25.** 6/?. **26.** 12⅗. **27.** 1⅛.
28. 1 7/45. **29.** 9/20. **30.** 11/196. **31.** 9/121. **32.** 15/512. **33.** 1/3?. **34.** 1 13/?.
35. 3 11/15. **36.** 73/128. **37.** 2⅘. **38.** 12 5/64. **39.** 256. **40.** 2 43/105. **41.** 33.
42. 10. **43.** 25. **44.** 5. **45.** 28. **46.** 2⅔. **47.** 2 4/85. **48.** 1½.
49. 47/80. **50.** 23/150. **51.** ¼. **52.** 1/90. **53.** 4/125. **54.** 3/50. **55.** 2½.
56. 3 8/35. **57.** 3 7/75.

Page 101. — **2.** ¼. **3.** ⅛. **6.** $1.40 ; $2.10 ; $2.80. **7.** 50 ¢.
8. 120 cords. **9.** 37 in. **10.** $7350. **11.** $285. **12.** $51. **13.** $45.
14. $1080.

Page 103. — **2.** 105. **3.** 225. **4.** 880. **5.** 270 ft. **6.** 840 bu.
7. 600 lb. **8.** $100. **9.** 18 ¢. **10.** $11,340. **11.** $1.80. **12.** $2.25.
13. $6. **14.** $7.50. **15.** $75. **16.** $3.75. **17.** $6.75. **18.** $72.
19. $12.75. **20.** $9.72. **21.** $4.20. **22.** $2. **23.** $1.60. **24.** $1.96.
25. $20.36. **26.** $8.80. **27.** $16.60. **28.** $2.60. **29.** $3.36.

Page 105. — **29.** $4. **30.** $3. **31.** $4. **32.** $5. **33.** $32. **34.** $10
35. $6¼. **36.** $15. **38.** $17½. **39.** $3. **40.** $12½. **41.** $9.
42. $5. **43.** $1. **44.** $40. **45.** $7. **46.** $7. **47.** $4. **48.** $2.
49. $2. **50.** $1. **51.** $6. **52.** $3. **53.** $5.

Page 106. — **65.** 20. **66.** 32. **67.** 80. **68.** 36. **69.** 32. **70.** 24.
71. 54. **72.** 160. **73.** 120. **74.** 30. **75.** 24. **76.** 75. **77.** 1120.
78. 320. **79.** 96. **80.** 120. **81.** 200. **82.** 800. **83.** 128. **84.** 180.
85. 60.

Page 108. — **12.** 28 qt. **13.** 4 pk. **14.** 7 pk. **15.** 32 pt. **16.** 7 pt.
17. 99 in. **18.** 18 ft. **19.** 12 qt. **20.** 22 qt. **21.** 104 oz. **22.** 108 oz.
23. 56 qt. **24.** 30 hr. **25.** 6 qt. **26.** 3500 lb. **27.** 90 sec. **28.** 7 qt.
29. 26 qt. **30.** 162 sq. ft. **31.** 24⅔ ft. **32.** 324 sq. in. **33.** 7 qt.
34. 12 pt. **35.** 80 oz. **36.** 126 in. **37.** 112 pt. **38.** 2¼ ft. **39.** 30 15/16 ft.
40. 400 rd. **41.** 324 sq. in.

Page 109. — **43.** 32 yd. **44.** 4½ gal. **45.** 6 bu. **46.** 8 lb.
47. 8 gal. **48.** 2 da. **49.** 21 qt. **50.** 240 bu. **51.** 15 yd. **52.** 3 mi.
53. 15 lb. **54.** 14 T. **55.** 24 hr. **56.** 2 hr. **57.** 10 rd. **58.** 43 yd.
59. 41 pk. **60.** 2 T. **61.** 20 lb. **62.** 4½ ft. **63.** 40 pk. **64.** 7 bu.
65. 4 rd. **66.** 13 mi. **67.** 2½ T. **68.** 25 min. **69.** 21 wk.
70. 2 da. **71.** 24 yd. **72.** 19 bu. **74.** $1.75. **75.** $3.20. **76.** $9

Page 110. — **77.** 63 ¢.   **78.** $117 34.   **79.** $1.   **80.** $1.20.   **81.** $2.
82. 75 ¢.   **84.** $.60.   **85.** $.75.   **86.** $3.59.   **87.** $3.92.
88. $14.40.   **89.** $2.04.   **90.** $10.44.

Page 111. — **2.** $1.   **3.** $3 ; $6 ; $4.50.   **4.** 25 ¢ ; 15 ¢ ; 30 ¢.
5. $2.40.   **6.** $36.   **7.** 572 mi. ; 364 mi. ; 312 mi.   **8.** $37 ; $296 ;
$148.   **9.** $1.25 ; $1.75 ; $2.50.   **10.** 5 bolts ; 9 bolts.   **11.** 2 hr.

Page 112. — **12.** 10 hanks ; 15 hanks ; 22½ hanks.   **13.** $1.05 ; $1.75 ;
63 ¢.   **14.** $11.70 ; $19.50 ; $26 ; $14.30.   **15.** $12.32.   **16.** $33.60.
17. $1314.   **18.** $9.   **20.** $2.80.   **21.** $900.   **22.** $60 ; $75 ; $90.
23. 9 yd. ; 12 yd.; 24 yd.   **24.** $¾.

Page 113. — **25.** 22½ mi.   **26.** $1000.   **27.** 240 bu.   **28.** 30 ¢ ;
60 ¢ : $1.20.   **29.** $8.40.   **30.** $6.   **31.** $2.50.   **33.** 16 yd.   **34.** 8 yd.
35. 8 yd.   **37.** $6.   **38.** 50 ¢.   **39.** $1.   **40.** $2.   **41.** 75 ¢.   **42.** $4.
43. $6.

Page 117. — **2.** $\frac{3}{20}$.   **3.** $\frac{23}{40}$.   **4.** $\frac{9}{10}$.   **5.** $\frac{13}{40}$.   **6.** $\frac{3}{4}$.   **7.** $\frac{7}{40}$.   **8.** $\frac{1}{8}$.
9. $\frac{17}{40}$.   **13.** $\frac{9}{20}$.   **14.** $\frac{5}{8}$.   **15.** $\frac{17}{20}$.   **16.** $\frac{13}{20}$.   **17.** $\frac{3}{8}$.   **18.** $\frac{4}{5}$.   **19.** $\frac{1}{8}$.
20. $\frac{3}{5}$.   **21.** $\frac{23}{40}$.   **22.** $\frac{9}{10}$.   **23.** $\frac{24}{25}$.   **24.** $\frac{2}{5}$.

Page 118. — **2.** 1.015.   **3.** .165.   **4.** .146.   **5.** 9.1.   **6.** 13.189.
7. .0261.   **8.** 18.027.   **9.** .161.   **10.** 3.603.   **11.** 2.777.   **12.** 6.052.
13. 10.856.   **14.** 15.728.   **15.** 13.356.   **16.** 21.355.   **17.** 2.9.

Page 119. — **18.** 17.165.   **19.** 143.192.   **20.** 33.793.   **21.** 137.768.
22. 26.676.   **23.** 2171.812.   **24.** 14.815.   **25.** 225.303.   **26.** 47.97.
27. 19.5 in.   **28.** $8.94.   **29.** 82.1 mi.   **30.** 113.5 ft.   **31.** 23.93 mi.
32. 2277.225.   **33.** 850 qt.

Page 120. — **2.** 5.79.   **3.** 12.954.   **4.** .305.   **5.** 180.892.   **6.** 16.02.
7. 72.927.   **8.** 695.725.   **9.** 18.835.   **10.** 131.745.   **11.** 38.615.
12. 32.996.   **13.** 108.967.   **14.** $3.75.   **15.** 5.375 mi.   **16.** 55.75 A.

Page 121. — **17.** $2.20.   **18.** 10.86 ft.   **19.** 28.46 ft.   **20.** $2.05.
21. 6.75 mi.   **22.** 5.125 A.   **23.** .375 lb.   **24.** 27.65 T.   **25.** 60 T.
26. $6.32.   **27.** $38.55.

Page 123. — **4.** .12.   **5.** .045.   **6.** 3.06.   **7.** 5.175.   **8.** 246.4.
9. 487.5.   **10.** 613.2.   **11.** 1088.1.   **12.** 1414.4.   **13.** 1774.8.
14. 3060.   **15.** 105.3.   **16.** 2.24.   **17.** 151.04.   **18.** .596.   **19.** 1261.6.
20. 3184.72.   **21.** 3.59.   **22.** 2.928.   **23.** 3.225.   **24.** 1.981.
25. 432.904.   **26.** 228.03.   **27.** 1232.413.   **28.** 679.06.   **29.** 262.116.
30. 257,352.83.   **31.** 5638.844.   **32.** 123.6.   **33.** 17,561.25.   **34.** 12.432.
35. 607.92.   **36.** 25,647.221.   **37.** $5.74.   **38.** 1980 ft.   **39.** 108 sq. in.

Page 124. — **40.** $8.40.   **41.** 478.5 ft.   **42.** $46.65.   **43.** $22.72.
44. 1750 lb.   **45.** 248.5 mi.   **46.** 6 ; 8 ; 8.4 ; 8.6 ; 7.6 ; 6.5 ; 5.4 ; .05.
47. 30 ; 20 ; 2.5 ; 210 ; 235 ; 28,350 ; 239.   **48.** 60 ; 80 ; 84 ; 95 ; 86 ; 76 ;
6 ; 4 ; .5 ; 423 ; 5670 ; 47.8 ; 860 ; 980 ; 59.4 ; 594 ; 5940.   **49.** $3.
50. $4.46.   **51.** $21.   **52.** $3.50.   **53.** $.75.   **54.** $.50.   **55.** $480.
56. $300.   **57.** $2.34.   **58.** $49.50.   **59.** $.75.   **60.** $156.25.
61. $1.69.   **62.** 55.44 in.   **63.** 354 ft.

Page 125. — **4.** .11.   **5.** .32.   **6.** .101.   **7.** .102.   **8.** .107.
9. .212.   **10.** 1.121.   **11.** 1.156.   **12.** 1.112.

Page 126. — 19. 3.04.   **20.** 2.11.   **21.** 6.1.   **22.** 22.3.   **23.** .101.
24. 3.4.   **25.** .039.   **26.** .124.   **27.** .027.   **28.** 1.16.   **29.** .022.
30 .036.   **31.** .14.   **32.** .17.   **33.** .029.   **34.** .032.   **35.** .143.
36. 6.14.   **37.** 6.04.   **38.** .089.   **39.** .475.   **40.** .605.   **41.** .065.
42. .904.   **43.** .25.   **44.** .04.   **45.** .0005.   **46.** .125.   **47.** .035.
48. .0001   **49.** .0001.   **50.** .0003.   **51.** .0015.   **52.** .0888.   **53.** 2.5.
54. .21.   **55.** .0015.   **56.** .026.   **57.** .0003.   **58.** .023.   **59.** .065.
60. 2.03.   **61.** 7.2.   **62.** .36.   **63.** .017.   **64.** .045.   **65.** .8⅘.
66. .042.   **67.** .018.   **68.** .75.   **69.** 7.81.   **70.** .651⅔.   **71.** 4.45.
72. 4.43.

Page 127. — 73. .075.   **74.** .075.   **75.** 1.045.   **76.** 1.056.   **77.** 8.
78. .3.   **79.** .02.   **80.** .001.   **81.** .002.   **82.** .3.   **83.** .3.   **84.** .03.
85. .170⅔.   **86.** .034.   **87.** .003.   **88.** .12.   **89.** 1.005.   **90.** .009.
91. 1.13.   **92.** .072.   **93.** 1.036.   **94.** .04.   **95.** .225.   **96.** 1.04
97. .05.   **98.** .007.   **99.** .011.   **100.** .006.   **101.** .39125 A.
102. $521.92.   **103.** 1.225 mi.   **104.** 258.16 bu.   **105.** $.149.
106. $.004.   **107.** $.004.   **108.** $.046.   **109.** $.214.

Page 128. — 2. .26⅔.   **3.** .4.   **4.** .10¹⁰⁄₁₃   **5.** .08.   **6.** .44½.   **7** .5.
8. .2   **9.** .5.   **10.** .5.   **11.** .25.   **12.** .125.   **13.** .5.   **15** .2.
16. .375.   **17.** .4.   **18.** .625.   **19** .875.   **20.** .6.   **21** .0625.
22. .3125.

Page 129. — 1. .33⅓.   **2.** .16⅔   **3.** .08¼   **4.** .66⅔.   **5.** .142⅖.
6. .416⅔.   **7.** .428⁴⁄₇.   **8.** .111⅑.   **9.** .583⅓.   **10.** .714²⁄₇.   **11.** .5625.
12. .6875.   **13.** .52.   **14.** .55.   **15.** .454₆⁄₁₁.   **16.** .916⅔.   **17.** .733⅓.
18. .857⅐.   **19.** .555⅚.   **20.** .833⅓.   **21.** 5.25.   **22.** 4.5.   **23.** 3.125.
24. 8.2.   **25.** 3.66⅔.   **26.** 7.25.   **27.** 8.1.   **28.** 6.16⅔.   **29.** 3.4.
30. 5.875.   **31.** 3.75.   **32.** 2.875.   **33.** 2.142⁶⁄₇.   **34.** 3.6.   **35.** 8.111⅑.
36. 2.8.   **37.** 2.428⁴⁄₇.   **38.** 1.375.   **39.** 1.625.   **40.** 7.833⅓.   **41.** 2.15.
42. 2.714²⁄₇.   **43.** 2.08⅓.   **44.** 1.35.   **45.** 8.1875.   **46.** 6.222⅔.
47. 9.416⅔.   **48.** 4.3125.   **49.** 3.583⅓.   **50.** 6.4875.   **51** 8.33⅓.
52. 12.5.   **53.** 33.33⅓.   **54.** 87.5.   **55.** 16.66⅔.   **56.** 62.5.   **57.** 87.5.
58. 31.25.   **59.** 66.66⅔.   **60.** 83.33⅓.

Page 131. — 7. 480 rd.   **12.** 540 ft.   **13.** 1291½ ft.   **14.** 228 ft.
15. 5940 ft.   **16.** 16 trips.

Page 132. — 3. a. 35 ft. ; b. 30 ft. ; c. 25 ft. ; d. 20 ft. ; e. 15 ft.
4. Width, 35 ft. ; length, 45 ft.   **5.** 40 ft.   **6.** 57½ ft.   **7.** 27½ ft.
8. 30 yd.   **9.** 40 yd.   **10.** 45 yd.   **11.** 10 rd.   **12.** 15 rd.   **13.** 25 rd.
14. 15 mi.   **15.** 27½ mi.   **16.** 32½ mi.

Page 134. — 35. 35 mi. ; 20 mi. ; 30 mi   10 mi.   **36.** Room, 24 ft. ×
46 ft. , pupil's desk, 3 ft. × 2 ft. ; teacher's desk, 5 ft. × 2 ft.

Page 135. — 1. $2.50.

Page 136. — 2. $2.94.   **3.** $13.05.   **4.** ¢ 90   **5.** $2.16.   **6.** $82.25.
7. $23.50.   **8.** $2.15.   **9.** $17.90.   **10.** $3.5.

Page 137. — 11. $64.   **12.** $2.30.   **13.** $5.85.   **14.** $62.   **15.** $5.60.
16. $3.32.   **17.** $3.10.   **18.** $21.95.   **19.** $2.98.

Page 140.—9. $3902.50. **10.** 5 pencils; 8 pencils. **11.** 9 lb.
12. $63. **13.** $2.70. **14.** (a) $80; (b) $90. **15.** $2.40. **16.** $3.75.
17. $.334. **18.** $3. **19.** $300.

Page 141.—20. Latter; $1.25. **21.** $25. **22.** $28.40. **23.** $1.80.
24. 72 peach trees. **25.** $15,000. **26.** $5680. **27.** $1.80.
28. 268⅛ rd. **29.** 7401¼ mi. **30.** 1409³⁄₁₅ T. **31.** $38.03. **32.** $1.32¹¹⁄₁₃.
33. 2½ mi.

Page 142.—34. 23 installments. **35.** $64.26. **36.** $720.
37. 14,910 pads. **38.** Latter; 2 ¢ per pound. **39.** Heated apartment,
¢ 24. **40.** $1. **41.** 75 ¢. **42.** $6.85. **43.** 5952²⁄₂₁ T. **44.** $28.81.

Page 143.—1. $1.05. **2.** $6.75. **3.** $15. **4.** $1.80. **5.** $5.40.
6. $3. **7.** $2.48. **8.** $.96. **9.** $4.38. **10.** $3. **11.** $5.25
12. $2.76. **13.** $1.75. **14.** $1.02. **15.** $.53. **16.** $3.60.
17. $1.25. **18.** $6. **19.** $4.50. **20.** $.75. **21.** $16.10.

Page 144.—1. 48.75 bu.; 42.25 bu. **2.** 3,158,800,000 bu.
3. $114.636. **4.** 3⅓ ¢. **5.** $.36; $.45. **6.** $.25. **7.** $21.81.

Page 145.—1. 129.6 lb. **2.** $5.49. **3.** 8.1 lb. **4.** $7.58.
5. 1.594 lb. **6.** $12.08. **7.** $.05. **8.** Boy's expense, $.03; father's
expense, $.08; boy's profit, $44.20 more.

Page 147.—1. $.98. **2.** $2.80. **3.** $4.51. **4.** $2.43. **5.** $8.52.
6. $.15. **7.** $.60. **8.** $.14. **9.** $2.08. **10.** $10.08. **11.** $.30.
12. $.28. **13.** $.57. **14.** $.19. **15.** $.68. **16.** $.29. **17.** $.36.
18. $.76. **19.** $.57. **20.** $2.38. **21.** $.83. **22.** $5.01. **23.** $3.40.
24. $.75. **25.** $3.34. **26.** $7.17. **27.** $3.19. **28.** $3.96.
29. $18.15 **30.** $10.88. **31.** $2.45. **32.** $4.67. **33.** $3.
34. $7.50. **35.** $14.38. **36.** $1.32. **37.** $3. **38.** $4.50. **39.** $6.
40. $9. **41.** $1.12. **42.** $12.75. **43.** $30. **44.** $1.51.

Page 148.—Set I: 1. 1½ in. **2.** 10.95. **3.** 386.4. **4.** 2.4
5. 1.01. **Set II: 1.** ⅓. **2.** 46.565. **3.** 21.234. **4.** .162. **5.** .025.
Set III: 1. 84. **2.** 3.234. **3.** 517.225. **4.** 12.915. **5.** .271.
Set IV: 1. 1½. **2.** 38.113. **3.** 44.941. **4.** 658.6. **5.** 1.675.
Set V: 1. ⅔. **2.** 103.851. **3.** 2.175. **4.** 102.6. **5.** .314. **Set VI:**
1. ⅓. **2.** 11.364. **3.** 30.875. **4.** 4.912. **5.** .011. **Set VII: 1.** 24
2. 179.553. **3.** 201.001. **4.** 79.61. **5.** .16. **Set VIII: 1.** 42.
2. 545.454. **3.** 218.452. **4.** 10,095. **5.** .0625.

Page 149.—2. 3213. **3.** 3564. **4.** $2719.09. **5.** 2,512,981
6. 3,563,354. **7.** 3,010,438. **9.** 4627 **10.** 4586. **11.** 4936. **12.** 3535.
13. 2385.

Page 150.—14. 3,292,939. **15.** 3,492,086. **16.** 3,733,210
17. 3,207,905. **18.** 2,343,929. **19.** 3,994,312. **20.** 2,568,619.
21. 3,172,724. **22.** 3,583,266. **23.** 3,166,719. **24.** $42,402.89.
25. $27,795.77. **26.** $2646.60.

Page 151.—2. 145. **3.** 3604. **4.** 43,194. **5.** 17,087. **6.** $101.91.
7. $329.04. **8.** $249.25. **9.** $120.40. **10.** 51,331. **11.** 14,489.
12. 288,307. **13.** 295,852. **14.** 22,555. **15.** 17,202. **16.** 84,846.
17. 1,123,457. **18.** $654.11.

Page 152. — 2. \$175.42. **3.** \$1745.92. **4.** \$2389.75. **5.** \$608.36.
6. \$337.50. **7.** \$1354.64. **8.** \$255.06. **9.** \$323.44. **10.** \$1555.50.
11. \$154.66. **12.** \$2154.50. **13.** \$1690.81.

Page 153. — 5. 3762 ; 4158 ; 4950. **6.** 6555 ; 7245 ; 8625. **7.** 4826 ;
5334 ; 6350. **8.** 154,250 ; 122,166 ; 124,634. **9.** 383,625 ; 303,831 ; 309,969.
10. 523,625 ; 414,711 ; 423,089. **11.** 1,747,440 ; 7,135,380 ; 7,426,620.
12. 1,522,896 ; 6,218,492 ; 6,472,308. **13.** 1,728,432 ; 7,057,764 ; 7,345,836.
16. *a.* 1,574,125 ; *b.* 2,210,200 ; *c.* 3,623,700 ; *d.* 4,793,050 ; *e.* 5,165,700 ;
f. 6,174,425 ; *g.* 5,588,325 ; *h.* 5,114,300. **17.** *a.* 250,880 ; *b.* 352,256 ;
c. 577,536 ; *d.* 763,904 ; *e.* 823,296 ; *f.* 984,064 ; *g.* 889,856 ; *h.* 815,104.
18. *a.* 2,136,400 ; *b.* 2,999,680 ; *c.* 4,918,080 ; *d.* 6,505,120 ; *e.* 7,010,880 ;
f. 8,379,920 ; *g.* 7,577,680 ; *h.* 6,941,120. **19.** *a.* 2,364,740 ; *b.* 3,320,288 ;
c. 5,443,728 ; *d.* 7,200,392 ; *e.* 7,760,208 ; *f.* 9,275,572 ; *g.* 8,387,588 ;
h. 7,682,992. **20.** *a.* 2,122,925 ; *b.* 2,980,760 ; *c.* 4,887,060 ; *d.* 6,464,090 ;
e. 6,966,660 ; *f.* 8,327,065 ; *g.* 7,529,885 ; *h.* 6,897,340. **21.** *a.* 1,934,030 ;
b. 2,715,536 ; *c.* 4,452,216 ; *d.* 5,888,924 ; *e.* 6,346,776 ; *f.* 7,586,134 ;
g. 6,859,886 ; *h.* 6,283,624. **22.** *a.* 2,073,925 ; *b.* 2,911,960 ; *c.* 4,774,260 ;
d. 6,314,890 ; *e.* 6,805,860 ; *f.* 8,134,865 ; *g.* 7,356,085 ; *h.* 6,738,140.
23. *a.* 1,885,275 ; *b.* 2,647,080 ; *c.* 4,339,980 ; *d.* 5,740,470 ; *e.* 6,186,780 ;
f. 7,394,895 ; *g.* 6,686,955 ; *h.* 6,125,220.

Page 154. — 4. $1892\frac{1}{4}$; $756\frac{9}{10}$; $473\frac{1}{15}$; $75\frac{69}{100}$. **5.** 2512 ; $10044\frac{1}{2}$; 628 ;
$1001\frac{1}{2}$. **6.** 4510 ; 1804 ; $1127\frac{1}{2}$; $180\frac{2}{5}$. **7.** $3703\frac{18}{25}$; $1481\frac{18}{25}$; $925\frac{19}{25}$;
$148\frac{79}{500}$. **8.** \$204.92$\frac{1}{2}$; \$81.97 ; \$51.23$\frac{1}{2}$; \$8.19$\frac{7}{10}$. **9.** \$395.03$\frac{1}{2}$;
\$158.01$\frac{1}{2}$; \$98.75$\frac{15}{16}$; \$15.80$\frac{5}{16}$. **10.** \$195.02$\frac{1}{2}$; \$78.01 ; \$48.75$\frac{1}{4}$;
\$7.80$\frac{1}{16}$. **11.** \$492.51$\frac{1}{2}$; \$197.00$\frac{1}{2}$; \$123.12$\frac{11}{12}$; \$19.70$\frac{7}{16}$.
12. *a.* $24,120\frac{181}{268}$; *b.* $18,260\frac{301}{354}$; *c.* $9562\frac{479}{531}$; *d.* $8528\frac{117}{531}$. **13.** *a.* $29,278\frac{54}{77}$;
b. $22,165\frac{175}{777}$; *c.* $11,607\frac{187}{185}$; *d.* $10,351\frac{351}{185}$. **14.** *a.* $21,882\frac{43}{57}$; *b.* $16,566\frac{57}{57}$;
c. $8675\frac{62}{169}$; *d.* $7736\frac{349}{339}$. **15.** *a.* $32,273\frac{179}{268}$; *b.* $24,433\frac{61}{354}$; *c.* $12,794\frac{277}{531}$;
d. $11,410\frac{563}{759}$.

Page 155. — 1. $\frac{4}{3}$. **2.** $\frac{7}{4}$. **3.** $\frac{11}{6}$. **4.** $\frac{7}{12}$. **5.** $\frac{9}{20}$. **6.** $\frac{9}{16}$.
7. $\frac{907}{25}$. **8.** $\frac{979}{20}$. **9.** $\frac{803}{50}$. **10.** $\frac{163}{8}$. **11.** $\frac{7}{25}$. **12.** $\frac{182}{15}$.
13. $3\frac{5}{8}$. **14.** $6\frac{1}{4}$. **15.** $6\frac{1}{4}$. **16.** $9\frac{3}{4}$. **17.** $8\frac{1}{4}$. **18.** $8\frac{1}{4}$. **19.** \$15$\frac{7}{8}$.
20. $5\frac{5}{16}$ lb. **21.** $8\frac{15}{16}$ hr. **22.** $10\frac{5}{6}$ mi. **23.** $6\frac{11}{12}$ ft. **24.** $8\frac{5}{6}$ bu.
25. $\frac{1}{2}$. **26.** $\frac{3}{8}$. **27.** $\frac{13}{21}$. **28.** $\frac{7}{15}$. **29.** $\frac{7}{20}$. **30.** $\frac{5}{12}$. **31.** $\frac{7}{9}$. **32.** $\frac{3}{8}$.
33. $\frac{11}{15}$. **34.** $\frac{13}{22}$. **35.** $\frac{1}{5}$. **36.** $\frac{7}{8}$. **37.** $\frac{3}{8}$. **38.** $\frac{24}{25}$. **39.** $\frac{7}{15}$.
40. $\frac{8}{6}$, $\frac{3}{6}$; $\frac{5}{6}$. **41.** $\frac{8}{12}$, $\frac{3}{12}$; $\frac{5}{12}$. **42.** $\frac{4}{20}$, $\frac{5}{20}$; $\frac{9}{20}$. **43.** $\frac{8}{12}$, $\frac{9}{12}$; $1\frac{5}{12}$.
44. $\frac{20}{24}$, $\frac{9}{24}$; $1\frac{5}{24}$. **45.** $\frac{27}{72}$, $\frac{48}{72}$; $1\frac{19}{72}$. **46.** $\frac{56}{72}$, $\frac{27}{72}$; $1\frac{11}{72}$. **47.** $\frac{30}{35}$, $\frac{28}{35}$; $1\frac{23}{35}$.
48. $\frac{8}{72}$, $\frac{45}{72}$; $1\frac{5}{72}$. **49.** $\frac{9}{30}$, $\frac{20}{30}$; $\frac{29}{30}$. **50.** $\frac{40}{120}$, $\frac{45}{120}$, $\frac{96}{120}$; $1\frac{61}{120}$. **51.** $\frac{45}{63}$,
$\frac{14}{63}$, $\frac{12}{63}$; $1\frac{8}{63}$. **52.** $\frac{35}{40}$, $\frac{16}{40}$, $\frac{12}{40}$; $1\frac{23}{40}$. **53.** $\frac{25}{60}$, $\frac{28}{60}$, $\frac{40}{60}$; $1\frac{33}{60}$. **54.** $\frac{36}{63}$, $\frac{21}{63}$,
$\frac{49}{63}$; $1\frac{43}{63}$. **55.** $\frac{25}{60}$, $\frac{35}{60}$; $1\frac{10}{60}$. **56.** $\frac{36}{40}$, $\frac{35}{40}$; $1\frac{31}{40}$. **57.** $\frac{8}{12}$, $\frac{9}{12}$, $\frac{6}{12}$; $1\frac{11}{12}$.
58. $\frac{28}{42}$, $\frac{36}{42}$, $\frac{35}{42}$; $2\frac{5}{42}$. **59.** $\frac{216}{252}$, $\frac{28}{252}$, $\frac{63}{252}$; $1\frac{55}{252}$. **60.** $\frac{42}{96}$, $\frac{28}{96}$, $\frac{27}{96}$; $\frac{97}{96}$.
61. $\frac{15}{28}$, $\frac{22}{28}$, $\frac{16}{28}$; $1\frac{7}{8}$. **62.** $3\frac{15}{24}$, $\frac{14}{24}$, $2\frac{9}{24}$; $6\frac{2}{3}$. **63.** $\frac{8}{60}$, $\frac{25}{60}$, $\frac{45}{60}$; $1\frac{1}{10}$. **64.** $5\frac{9}{13}$,
$\frac{5}{13}$, $6\frac{8}{13}$; $12\frac{1}{2}$. **65.** $9\frac{6}{24}$, $7\frac{3}{24}$, $12\frac{18}{24}$; $30\frac{7}{12}$. **66.** $8\frac{24}{280}$, $\frac{240}{280}$, $4\frac{175}{280}$; $14\frac{79}{280}$.
67. $6\frac{34}{84}$, $2\frac{63}{84}$, $5\frac{63}{84}$; $14\frac{40}{84}$. **68.** $3\frac{40}{90}$, $\frac{45}{90}$, $15\frac{54}{90}$; $19\frac{49}{90}$. **69.** $4\frac{63}{72}$, $\frac{28}{72}$, $20\frac{64}{72}$;
$26\frac{11}{72}$.

Page 156. — 70. $\frac{7}{85}$. **71.** $1\frac{5}{6}$. **72.** $3\frac{1}{5}$. **73.** $2\frac{17}{20}$. **74.** $4\frac{5}{8}$. **75** $6\frac{1}{4}$.
76. $5\frac{7}{8}$. **77.** $19\frac{14}{15}$. **78.** $4\frac{6}{75}$. **79.** $11\frac{7}{8}$. **80.** $5\frac{11}{4}$. **81.** $5\frac{7}{10}$.
82. $1\frac{49}{60}$. **83.** $32\frac{1}{4}$. **84.** $25\frac{2}{15}$. **85.** $7\frac{9}{10}$. **86.** $66\frac{11}{15}$. **87.** $10\frac{6}{8}$.
88. $\frac{74}{12}$. **89.** $4\frac{1}{3}$. **90.** $5\frac{3}{4}$. **91.** $1\frac{7}{8}$. **92.** $8\frac{9}{10}$. **93.** $15\frac{8}{15}$. **94.** $131\frac{1}{4}$.

95. 9 17/32. **96.** 23 7/18. **97.** 5 49/72. **98.** 6. **99.** 21. **100.** 18. **101.** 20.
102. 4. **103.** 10. **104.** 9½. **105.** 12 5/9. **106.** 13⅓. **107.** 6⅞.
108. 4⅘. **109.** 14 7/12. **110.** 2⅔. **111.** 11/20. **112.** 21. **113.** 13.
114. 20½. **115.** 44. **116.** 96⅔. **117.** 94⅘. **118.** 49½. **119.** 59½.
120. 24⅓. **121.** 150⅔. **122.** 5/9. **123.** 3/7. **124.** ⅝. **125.** 1 4/7.
126. 5/16. **127.** ⅔. **128.** ⅜. **129.** ⅔. **130.** 45/64. **131.** 5/18. **132.** 5/12.
133. 21/100. **134.** 21/32. **135.** 9/20. **136.** 9/20.

Page 157. — **137.** 2. **138.** 9½. **139.** 10 13/24. **140.** 3 37/72. **141.** 14½.
142. 85⅞. **143.** 117. **144.** 24. **145.** 2633⅔. **146.** ⅞. **147.** ⅜.
148. 4/15. **149.** 3/16. **150.** 8/25. **151.** 1/17. **152.** 6/55. **153.** 3/25.
154. 3/5. **155.** 5/32. **156.** 24. **157.** 24. **158.** 108. **159.** 18.
160. 30. **161.** 40. **162.** 77. **163.** 60. **164.** 56. **165.** 44.
166. 11½. **167.** 33½. **168.** 11½. **169.** 10½. **170.** 11½. **171.** 170½.
172. 29¾. **173.** 68⅝. **174.** 34⅔. **175.** 112 9/10. **176.** 1 1/16. **177.** 1.
178. 29/42. **179.** 1⅞. **180.** 9/7. **181.** 1 2/3. **182.** 1½. **183.** ⅛.
184. 2⅔. **185.** 2 4/15. **186.** 1½. **187.** 47/80. **188.** 25. **189.** 5. **190.** 14.
191. 18½. **192.** 28⅞. **193.** 132. **194.** 336. **195.** 75⅝. **196.** 100⅝.
197. 1 1/20. **198.** 1 9/16. **199.** 2⅓. **200.** 1 1/14. **201.** ¾. **202.** 1 4/7.
203. 1⅖. **204.** 1 1/52. **205.** 2 6/85. **206.** 2½. **207.** 1⅓. **208.** 3.
209. 3½. **210.** 1½. **211.** 3.

Page 161. — **3.** 91.983. **4.** 164.97. **5.** 36.502. **6.** 134.7. **7.** 1.268.
8. .6243. **9.** 310.8. **10.** 26.3. **11.** 30.383. **12.** 48.396. **13.** 48.065.
14. 25.119. **15.** .6773. **16.** .0467. **17.** .4191. **18.** 10.992.
19. 68.722. **20.** $ 23.59. **21.** 128.061. **22.** 170.375.

Page 162. — **23.** 926.9 ; 315.9. **24.** 1337.2 ; 327.4. **25.** 93.59 ; 20.51.
26. 17.0952 ; .9554. **27.** 17.454. **28.** 18.668. **29.** 19.131. **30.** 31.845.
31. 11.205. **32.** 37.544. **33.** 26.725. **34.** 27.1933. **35.** 41.6767.
36. 49.43451. **37.** 65.28829. **38.** 2171.2623. **39.** 2.075. **40.** 3.799.
41. 39.032. **42.** 8.999. **43.** 170.075. **44.** 46.0756. **45.** 256.2175.
46. 81.0081. **47.** 6.994. **48.** 106.9194. **49.** 5.006. **50.** 105.3.
51. 5.38875. **52.** 99.0001. **53.** 3.449. **54.** .141. **55.** 1.4002.
56. .0512.

Page 163. — **57.** 6.4 T. **58.** 15,135.625 ft. **59.** .5° ; 4.1° **60.** 2.71 in.
61. 3.71 in. **62.** 210 mi. **63.** 152.5 ft. **64.** 21.17 lb.

Page 165. — **18.** 2.24. **19.** 3.75. **20.** 2.52. **21.** 6.51. **22.** 5.44.
23. 3.48. **24.** 3.6. **25.** 4.55. **26.** 4.56. **27.** .03. **28.** .0308.
29. .0625. **30.** .1376. **31.** .2255. **32.** .090625. **33.** .034592.
34. .03075. **35.** .248814. **36.** .003404. **37.** .70632. **38.** 12.4476.

Page 166. — **39.** .456. **40.** 8.272. **41.** .00072. **42.** .002928.
43. .003225. **44.** .00581. **45.** .432904. **46.** .033696. **47.** .001212.
48. 12.5664. **49.** .010304. **50.** .001089. **51.** 5.202. **52.** 2.3328.
53. .040625. **54.** .002451. **55.** .00376. **56.** .119082. **57.** .045675.
58. .000484. **59.** .05372. **60.** 4.1283. **61.** 1.61604. **62.** .025488.
63. .068564. **64.** .004608. **65.** .042105. **66.** 1619.2. **67.** 3474.
68. 5943.2. **69.** 854.34. **70.** .001371. **71.** .004368. **72.** 39.781.
73. 189.6832. **74.** .9792. **75.** 1.64835. **76.** .00312. **77.** .01024.
78. .000288. **79.** .000625. **80.** .083712. **81.** .000016. **82.** .27775.

83. .005832. **84.** .003416. **85.** .000891. **86.** .010201. **87.** .093744.
88. .014592. **89.** .003686. **90.** 4.375. **91.** 19.008. **92.** 5.4945.
93. 21.0585. **94.** 35.358. **95.** 450.74. **96.** 323.5. **97.** 5.346.
98. 41.736. **99.** 5.9719. **100.** 6.4337. **101.** 72.24. **102.** .0245.
103. 75.11502. **104.** .000483. **105.** .0336. **106.** 1.82272. **107.** 19.5168.
108. 70.70707. **109.** 371.175. **110.** 61.0756. **111.** 19.70299. **112.** 285.6.
113. 29.302852. **114.** 1113.111. **115.** 265.972264. **116.** 9.61996.
117. 266.30656. **118.** 36.349848. **119.** 9.378369.

Page 167.—**1.** 45.45 lb. **2.** 2481.93 sq. ft. **3.** $6315.35. **4.** 26,621.99 sq. ft. **5.** 57.5 lb. **6.** 15 lb. **7.** 172.5 lb. **8.** 4 cu. ft.; 725 lb. **9.** 8.755 lb. **10.** $1195.06. **11.** 250.07136 ft.

Page 170.—**4.** 20. **5.** 150. **6.** 30. **7.** 1000. **8.** 200. **9.** 640. **10.** 48. **11.** 4000. **12.** 12,500. **13.** 550. **14.** 1500. **15.** 2500. **16.** 18.4. **17.** 48. **18.** 250. **19.** 256. **20.** 1000. **21.** 10,000. **22.** 25. **23.** 3500. **24.** 1200. **25.** 16,000. **26.** 150. **27.** 3500. **28.** 20. **29.** 3.2. **30.** .25. **31.** 1. **32.** .0122. **33.** .0078. **34.** 5.6. **35.** 1.4. **36.** 2.3625.

Page 171.—**37.** .016. **38.** .009. **39.** .01. **40.** 1.7. **41.** 1.5. **42.** 5. **43.** 6. **44.** 2.9. **45.** 40. **46.** 60. **47.** .08. **48.** 4. **49.** 10. **50.** 15. **51.** 1.8. **52.** 2.21. **53.** 2.05. **54.** 1200. **55.** .012. **56.** 560. **57.** 1.24. **58.** 1.3. **59.** 1.257. **60.** 12.57. **61.** .53. **62.** 6.2. **63.** 300. **64.** 90. **65.** .12. **66.** 1270. **67.** .365. **68.** .1. **69.** .1. **70.** 100. **71.** 12.5. **72.** 2.07. **73.** 4. **74.** 745. **75.** 9.7. **76.** 248. **77.** .018. **78.** .0055. **79.** 3.5. **80.** .53. **81.** 2.1. **82.** .575. **83.** 3.375. **84.** .1. **85.** 10. **86.** .1. **87.** 290. **88.** .35. **89.** 43.6. **90.** .384. **91.** 28.3. **92.** .000011. **93.** 100,000. **94.** 4. **95.** .0002. **96.** 210. **97.** .000685. **98.** 00023. **99.** 25. **100.** $.011. **101.** $14.27. **102.** 42 bu.

Page 172.—**103.** $20,762.50. **104.** $5.25; $5.75. **105.** $6.75; $350. **106.** 30 da. **107.** 5000 layers. **108.** $.08. **109.** 60 apples. **110.** $4.50. **111.** $35.31¼. **112.** 6.2 hr.

Page 173.—**4.** $\frac{7}{20}$. **5.** $\frac{8}{25}$. **6.** $\frac{8}{25}$. **7.** $\frac{1}{3}$. **8.** $\frac{3}{4}$. **9.** $\frac{1}{5}$. **10.** $\frac{5}{11}$. **11.** $\frac{1}{8}$. **12.** $\frac{3}{5}$. **13.** $\frac{5}{16}$. **14.** $\frac{3}{5}$. **15.** $\frac{1}{7}$. **16.** $\frac{1}{16}$. **17.** $\frac{1}{24}$. **18.** $\frac{5}{11}$. **19.** $\frac{1}{30}$. **20.** $\frac{1}{3}$. **21.** $\frac{1}{7}$. **22.** $\frac{7}{12}$. **23.** $\frac{53}{80}$.

Page 174.—**18.** .333⅓. **19.** .666⅔. **20.** .166⅔. **21.** .833⅓. **22.** .142⅞. **23.** .714⅔. **24.** .111⅑. **25.** .222⅖. **26.** .444⅘. **27.** .555⅝. **28.** .2857⅐. **29.** .7777⅞. **30.** .6363₇₁. **31.** .3571⅔. **32.** 2.1111⅑. **33.** 1.5714⅚. **34.** .2777⅚. **35.** .5384₁₃⁸. **36.** .0166⅔. **37.** 3.1428⁴⁄₇.

Page 176.—**6.** $10. **7.** $15. **8.** $4. **9.** $40. **10.** $30. **11.** $2. **12.** $.36. **13.** 3. **14.** 30. **15.** 75. **16.** 8. **17.** 1.5. **18.** 15. **19.** 7. **20.** $8. **21.** $2. **22.** $.90. **23.** 3 qt. **24.** 4 pk. **25.** 40 pt. **26.** 2 bu.

Page 177.—**2.** $106.65. **3.** $66.92. **4.** $126.48. **5.** $3.44⅘. **6.** $4.54. **7.** $31.71. **8.** $8.20. **9.** $200.40. **10.** $10.08. **11.** $35.035. **12.** $453.75. **13.** $741.85. **14.** $3035.25. **15.** $724. **16.** $6867.84. **17.** $157.50. **18.** 486 mi. **19.** $1934.40. **20.** $20. **21.** 403.2 rd. **22.** Food, $36; rent, $24; heat, etc., $12; clothing, $18; miscellaneous items, $30.

Page 179. — 1. $8.12. **2.** $6.97. **3.** $8.50. **4.** $7.65. **5.** $10.80.
6. $9.20.

Page 180. — 7. $10.22. **8.** $13.89. **9.** $13.84. **10.** $25.34.
11. $18.54. **12.** Balance, $20.29 ; total receipts, $74.05 ; total disbursements, $53.76.

Page 182. — 3. $2.83. **4.** $10.75.

Page 183. — 5. $39.30. **6.** $6.50. **7.** $21.17. **10.** $14.60. **11.** $7
12. $307.53.

Page 184. — 5. $8.75.

Page 188. — 2. 49 pt. **3.** 33 qt. **4.** 35 pt. **5.** 41 pt. **7.** 3 qt
8. 4 pt. **9.** 1½ pt. **10.** 1¾ pt. **11.** 7½ pt. **12.** 3¾ pt. **14.** 47 gal
15. 69 gal. **16.** 49 qt. **17.** 22 pt. **18.** 31 qt. **19.** 20 pt. **20.** 65
qt. **21.** 10 gal. **22.** 18½ qt. **23.** 12½ gal. **24.** 6 gal. 1 qt.; $4
25. 16 da. **26.** 46⅞ gal.

Page 189. — 27. 178⅘ bbl. **28.** $24. **29.** 2½ qt.

Page 190. — 1. 496 pt. **2.** 27 qt. **3.** 161 qt. **4.** 60 pk. **5.** 3½ pk.
6. 70 qt. **7.** 6 pk. **8.** 28 qt. **9.** 9 qt. **10.** 1 bu. **11.** 2 pk.
12. 4½ bu. **13.** 2½ pk.; 40 pt.; $1.60. **14.** 4 bu. 3½ pk. **15.** 70 pt
16. 1 bu. 3¾ pk.; $3.88. **17.** 55¹⁵⁄₁₆ bu. **18.** 34 lb.

Page 192. — 1. 101 oz. **2.** 6800 lb. **3.** 36 cwt. **4.** 34 lb. **5.** 3 T
6. 9600 lb. **8.** 50 lb. **9.** 1750 lb. **10.** 12 oz. **11.** 8 cwt. 75 lb.
12. 41 ¢; 98 ¢. **13.** $3.75 ; $2.07. **14.** 1 T. 10 cwt. **15.** 45 cwt.
16. $60. **17.** 3⅜⁰ lb.

Page 193. — 1. 7¼ lb. **2.** 6⅞ lb. **3.** 7 lb. **4.** 2 lb. **5.** 6 lb.
6. 11¼ lb. **7.** 3½ lb. **8.** 6 lb. **9.** 8¾ lb. **10.** 7 lb. **11.** 120 lb.
12. 96 lb. **13.** 6660 lb. **14.** 230,400 lb. **16.** 30 bu.

Page 194. — 1. 18½ ft. **2.** 126 in. **3.** 69 yd. **4.** 43 in. **5.** 1604
rd. **6.** 240 rd. **7.** 5 ft. **8.** 4 yd. **9.** 128⅓ ft. **10.** 4320 turns.
11. 1452 ft.

Page 195. — 1. 186 min. **2.** 123 hr. **3.** 90 da. **4.** 1820 sec.
5. 5¼ da. **6.** 45 min. **7.** 3 min. **8.** 4 wk. **9.** 6 yr. **10.** 3 da.

Page 196. — 12. 32 mi. **13.** $4. **14.** 6 min. 18 sec. **15.** 54 mi.
200 rd. **16.** 270 mi. **17.** 192 mi. **18.** $41.60. **19.** 1920 hr.
20. 31¹²⁄₁₃ mi. per hour. **21.** 1⁴⁄₁₇ mi. per hour.

Page 197. — 1. $1.80. **2.** $3.36. **3.** $1. **4.** 3⅕ ¢. **5.** 12 doz.;
60 ¢. **6.** 5⅓ ¢. **7.** 86 yr. **8.** 1⁷⁄₁₂ ¢. **9.** $2.16 ; 54 ¢. **10.** $63.

Page 198. — 4. 10⁷⁄₁₂ ft.; ¹¹⁄₁₂ ft. **5.** 13¼ lb.; 3¾ lb. **6.** 22½ gal.; 10¼
gal. **7.** 20 bu.; 6½ bu. **8.** 13¹¹⁄₂₀ T.; 3¹⁄₂₀ T. **9.** 9⅔ wk.; 4⅔ wk.
10. 24¼ pk.; 6¾ pk. **11.** 8⁵⁄₁₂ yd.; 1¹¹⁄₁₂ yd. **12.** 15⅔ gross ; ⅚ gross or 10
doz. **13.** 15¼ hr.; 5⅞ hr.

Page 199. — 14. 85 ft. **15.** 52 lb. **16.** 183¾ gal. **17.** 44⅘ wk.
18. 82⅔ T. **19.** 23 min. **20.** 1 ft. ⅞ in. **21.** 6 qt. **22.** 204 lb. **23.** 3⁷⁄₁₆
yd. **24.** 19 ¢. **25.** 45 ¢. **26.** 78 ¢. **27.** $1.14. **28.** $1.68.
29. $1.69. **30.** $1.40. **31.** $1.64. **32.** 1 lb. 8 oz. **33.** 3 lb. 1 oz.
34. 18 ¢. **35.** $2.66. **36.** 20 ¢. **37.** 8 ¢. **38.** $1.07. **39.** 9 lb. 4 oz
41. 6 yr. 9 mo. 27 da. **42.** 15 yr. 16 da.

Page 200. — **43.** 4 yr. 3 mo. 7 da. **44.** 61 yr. 11 mo. 6 da. ; 67 yr 1 mo. 5 da. **45.** 55 yr. 3 mo. 7 da. **46.** 60 yr. 2 mo. 9 da. **47.** 84 yr. 9 mo. 8 da. **48.** 42 yr. 11 mo. 12 da. **49.** 56 yr. 2 mo. 3 da. **50.** 71 yr. 3 mo. 6 da. **51.** 76 yr. 7 mo. 25 da. **52.** 283 da. **53.** 260 da.

Page 201. — **1.** 384 pkg. **2.** $ 5.47 ; 9500 lb. **3.** $ 29.75. **4.** 37 gal. 1 qt. **5.** James, 12 small crates ; 9 large crates ; Mary, 13 small crates ; 9¾ large crates ; Martha, 14 small crates ; 10½ large crates ; John, 16 small crates ; 12 large crates. **6.** 225 hr. **7.** 7½ bu. **8.** 80 posts. **9.** 40 curbstones. **10.** 1 mi. 214 rd. ; 2 mi. 6 rd.

Page 202. — **11.** 30 days' work. **12.** $ 42.14. **13.** 4½ in. **14.** $ 3.20 **15.** 146 badges. **16.** 2178 steps. **17.** 5654 ft. **18.** 1080 turns. **19.** 28 ft. **20.** $ 3.50. **21.** 111 boxes. **22.** 227,568 ft.

Page 204. — **3.** 108 sq. ft. **4.** 32 sq. ft. **5.** 120 sq. ft. **6.** 28 sq. ft. **7.** 240 sq. ft. **8.** 144 sq. ft. **9.** 320 sq. ft. **10.** 96 sq. in. **11.** 144 sq. in. **12.** 64 sq. in. **13.** 256 sq. in. **14.** 21 sq. in. **15.** 246 sq. ft. **16.** 144.9 sq. ft. **17.** 2916 sq. yd. **18.** 24⁵⁄₈ sq. yd. **19.** 6210 sq. ft. **20.** 105 sq. yd. **21.** 27 sq. ft. **22.** 486 sq. ft.

Page 205. — **25.** 80 sq. yd. ; 36 yd. **26.** 24 sq. yd. ; 28 yd. **27.** 20 sq. yd. ; 18 yd.

Page 206. — **1.** 24,300 sq. ft. **2.** 7200 sq. in. **3.** 10 A. **4.** 260 sq. rd. **5.** 26¹⁴⁄₁₂₁ sq. rd. **6.** 250,470 sq. ft. **7.** 33¾ A. ; $ 2025. **8.** 8488 sq. ft. **9.** $ 100. **10.** $ 170.10. **11.** 4800 sq. ft. **12.** $ 1250. **13.** $ 16,800. **14.** $ 9750. **15.** $ 440. **16.** $ 232.

Page 207. — **17.** $ 400. **18.** $ 550. **19.** 3650 sq. ft. **20.** 36½ sq. in. **21.** $ 24. **22.** $ 42.63. **23.** 2400 sq. yd. **24.** $ 6450. **25.** 640 A. ; $ 54,400. **26.** 17⅔ bu. **27.** $ 3000 ; $ 3000. **28.** $ 126.72. **29.** 40 rd.

Page 208. — **4.** 40 sq. in. **5.** 36 sq. in. **6.** 225 sq. in. **7.** 432 sq. in.

Page 209. — **8.** 96 sq. ft. **9.** 160 sq. ft. **10.** 126 sq. ft. **11.** 216 sq. ft. **13.** 2112 sq. ft. **14.** 224 sq. ft. **15.** $ 38.94. **16.** 35 sq. ft. ; 172 sq. ft. **17.** 480 sq. ft.

Page 212. — **1.** 19,200 cu. ft. **2.** 711½ cu. yd. **3.** 12 cu. ft. **4.** 384 cubes. **5.** 40 sq. ft. **6.** 27,648 cu. in. **7.** 480 cu. ft. **8.** 385.71 bu. **9.** 3 T. **10.** 320 cu. ft. **11.** $ 88.89. **12.** 13⅝ loads ; $ 6.95. **13.** 9600 cu. ft. **14.** 320 cu. ft.

Page 213. — **15.** 810,000 cu. in. **16.** 3506⁶⁶⁄₇₇ gal. **17.** $ 462. **18.** ½ ; 3 lb. **19.** 153⅔ bu. **20.** 4308⁶⁹⁄₉₉ gal. **21.** 13⁵⁄₇ T. **22.** 32 T. **23.** 3.733 cu. ft. **24.** 54¾ bu. **25.** 8⁴⁸⁸⁄₈₅₅ bbl.

Page 214. — **1.** 20 A. ; 40 rd. to 1 in. **2.** 2½ A. ; 5 A. ; 3⅓ A. ; 1⅞ A. **3.** $ 90. **4.** $ 531.25. **5.** 540 tiles. **6.** 2899¾ ft. **7.** 4629⁴⁄₁₇ cu. yd. **8.** 1350 sq. ft. **9.** 1000 bu. **10.** 7181⁷⁷⁄₉₉ gal.

Page 215. — **11.** 50 rd. **12.** $ 11.44. **13.** 10 rd. **14.** 1728 cakes. **15.** $ 145.84. **16.** 15 A. **17.** 2048 bu. **18.** 4847⁷²⁄₉₉ gal. **19.** 150 ft. **20.** $ 387.20. **21.** 40 ft. **23.** 400 ft. ; 292 ft. ; 292 ft. ; 26 ft. ; 216 ft.

Page 216. — **24.** 1111½ sq. yd. **25.** 511⅓ sq. yd. **26.** 4½ sq. yd. **27.** 88⅝ sq. yd. **28.** $ 103.04. **29.** $ 137.78. **30.** $ .40. **31.** $ 182.40. **32.** $ 34.67. **33.** 2154³⁹⁄₇₇ gal. **34.** 60 farms. **35.** 3000 sods. **36.** $ 64.14. **37.** 48 persons. **39.** 888⅔ loads.

Page 218.—1. 180.   **2.** 173.   **3.** 1688.   **4.** $195.85.   **5.** $112.77.
6. $589.61.   **7.** 516.   **8.** 429.   **9.** 3427.   **10.** $127.83.   **11.** $103.28.
12. $926.88.   **13.** 101,988.   **14.** 183,216.   **15.** 5.   **16.** 201,849.
17. 101.646.   **18.** 52,414.   **19.** $226.13.   **20.** $26.64.   **21.** $1468.87.

Page 219.—22. $540.75.   **23.** $367.04.   **24.** $237,600.
25. $151,500.   **26.** $25,500.   **27.** $7800.   **28.** $270,000.   **29.** $21,800.
30. $1306.50.   **31.** $637.50.   **32.** $99,099.   **33.** $14,112.
34. $4001.50.   **35.** $1055.25.   **36.** $57,568.50.   **37.** .055.   **38.** .0476.
39. .00081.   **40.** 3.24.   **41.** 14.7.   **42.** 80.214.   **43.** 4.25.   **44.** .486.
45. .011055.   **46.** $5285.28.   **47.** $8718.27.   **48.** $1.701.
49. $1113.75.   **50.** $33,552.75.   **51.** $100.05.   **52.** 434.01.
53. $9000.   **54.** 60.375.   **55.** 110.   **56.** 30.   **57.** 1.02.   **58.** 44.
59. $9.66\frac{2}{3}$.   **60.** 15.27.   **61.** .1183952.   **62.** 2.0736.   **63.** 42.6725.
64. 1203.03208.   **65.** 1.925.   **66.** 1.296.   **67.** 6.   **68.** 7.936.
69. 31.296.   **70.** $3.53.   **71.** $8.04.

Page 220.—72. $77\frac{345}{367}$.   **73.** $95\frac{68}{367}$.   **74.** $59\frac{49}{80}$.   **75.** $179\frac{99}{840}$.
76. $153\frac{122}{149}$.   **77.** $181\frac{74}{119}$.   **78.** $83\frac{599}{878}$.   **79.** $138\frac{851}{878}$.   **80.** $581\frac{159}{598}$.
81. $95\frac{24}{45}$.   **82.** $77\frac{373}{785}$.   **83.** $363\frac{17}{117}$.   **84.** $105\frac{46}{315}$.   **85.** $99\frac{234}{235}$.
86. $84\frac{67}{155}$.   **87.** $136\frac{299}{587}$.   **88.** $236\frac{20}{903}$.   **89.** $15\frac{20}{23}$.   **90.** a. $2747\frac{98}{169}$;
b. $1828\frac{29}{254}$;   c. $1234\frac{357}{376}$;   d. $1013\frac{387}{453}$;   e. $1272\frac{61}{565}$;   f. $959\frac{184}{185}$;   g. $469\frac{899}{899}$;
h. $1169\frac{243}{248}$.   **91.** a. $5010\frac{70}{169}$;   b. $3333\frac{89}{169}$;   c. $2252\frac{7}{47}$;   d. $1848\frac{188}{199}$;
e. $2319\frac{65}{93}$;   f. $1749\frac{61}{93}$;   g. $856\frac{176}{199}$;   h. $2132\frac{359}{397}$.   **92.** a. $5115\frac{113}{121}$;
b. $3403\frac{98}{127}$;   c. $2299\frac{34}{94}$;   d. $1887\frac{151}{220}$;   e. $2368\frac{228}{385}$;   f. $1786\frac{31}{121}$;   g. $874\frac{163}{389}$;
h. $2177\frac{272}{397}$.   **93.** a. $3818\frac{95}{169}$;   b. $2540\frac{141}{254}$;   c. $1716\frac{42}{47}$;   d. $1409\frac{13}{199}$;
e. $1768\frac{21}{385}$;   f. $1333\frac{162}{484}$;   g. $652\frac{513}{889}$;   h. $1625\frac{216}{397}$.   **94.** a. $3697\frac{79}{169}$;
b. $2460\frac{16}{127}$;   c. $1661\frac{44}{47}$;   d. $1364\frac{80}{199}$;   e. $1711\frac{327}{385}$;   f. $1291\frac{1}{121}$;   g. $631\frac{313}{889}$;
h. $1573\frac{301}{397}$.   **95.** a. $4639\frac{105}{169}$;   b. $3087\frac{1}{127}$;   c. $2085\frac{9}{94}$;   d. $1712\frac{2}{229}$;
e. $2148\frac{16}{93}$;   f. $1620\frac{1}{121}$;   g. $792\frac{812}{889}$;   h. $1975\frac{55}{397}$.   **96.** a. $4795\frac{49}{169}$;
b. $3190\frac{72}{127}$;   c. $2155\frac{31}{94}$;   d. $1769\frac{191}{220}$;   e. $2220\frac{113}{385}$;   f. $1674\frac{47}{76}$;   g. $819\frac{113}{389}$;
h. $2041\frac{127}{397}$.   **97.** a. $5349\frac{44}{169}$;   b. $3559\frac{89}{127}$;   c. $2404\frac{41}{47}$;   d. $1973\frac{191}{454}$;
e. $2476\frac{57}{93}$;   f. $1867\frac{397}{484}$;   g. $914\frac{78}{889}$;   h. $2277\frac{56}{397}$.   **98.** 100.   **99.** 100.
100. 10.   **101.** 1000.   **102.** .05.   **103.** 300,000.   **104.** .1.
105. 100,000.   **106.** 100,000.   **107.** .00001.   **108.** .1.   **109.** .003.
110. 500.   **111.** 60,000.   **112.** .19.   **113.** 600,000.   **114.** 200,000.
115. 200,000.

Page 221.—116. .87.   **117.** .009.   **118.** .075.   **119.** 15.   **120.** .55.
121. .456.   **122.** .15.   **123.** 50.6.   **124.** 10.25.   **125.** .8.   **126.** 745.
127. 9.7.   **128.** 248.   **129.** .018.   **130.** 2.5.   **131.** 2.44.   **132.** 115.8.
133. 16.4.   **134.** $1\frac{1}{16}$.   **135.** $1\frac{3}{8}$.   **136.** $1\frac{1}{16}$.   **137.** $1\frac{9}{20}$.   **138.** $1\frac{1}{2}$.
139. $\frac{5}{9}$.   **140.** $1\frac{3}{8}$.   **141.** $1\frac{17}{21}$.   **142.** $5\frac{3}{4}$.   **143.** $5\frac{1}{3}$.   **144.** $8\frac{5}{8}$.
145. $8\frac{11}{14}$.   **146.** $\frac{5}{24}$.   **147.** $\frac{1}{30}$.   **148.** $1\frac{1}{10}$.   **149.** $\frac{5}{12}$.   **150.** $\frac{2}{3}$.   **151.** $\frac{1}{8}$.
152. $2\frac{1}{40}$.   **153.** $2\frac{3}{10}$.   **154.** $2\frac{1}{30}$.   **155.** $436\frac{5}{8}$.   **156.** $4183\frac{5}{6}$.   **157.** 403.
158. $2340\frac{1}{2}$.   **159.** 3863.31.   **160.** $6115\frac{1}{4}$.   **161.** $281\frac{1}{24}$.   **162.** $1504\frac{1}{8}$.
163. $680\frac{1}{8}$.   **164.** $863\frac{7}{16}$.   **165.** $708\frac{1}{8}$.   **166.** $381\frac{7}{8}$.   **167.** 18.   **168.** 16.
169. 35.   **170.** 48.   **171.** 24.   **172.** 40.   **173.** 20.   **174.** $1\frac{1}{2}$.
175. $1\frac{3}{32}$.   **176.** $1\frac{1}{24}$.   **177.** $1\frac{7}{4}$.   **178.** $\frac{3}{4}$.   **179.** 2.   **180.** $1\frac{1}{4}$.   **181.** $2\frac{3}{4}$.

Page 222. — **182.** $5\frac{5}{11}$.   **183.** 4.   **184.** $4\frac{4}{5}$.   **185.** $3\frac{3}{10}$.   **186.** $25\frac{17}{11}$.
187. $27\frac{18}{25}$.   **188.** $18\frac{7}{16}$.   **189.** $26\frac{7}{9}$.   **190.** $121\frac{11}{16}$.   **191.** $79\frac{7}{25}$.
192. $112\frac{81}{207}$.   **193.** $167\frac{67}{111}$.   **194.** $89\frac{17}{208}$.   **195.** $105\frac{27}{77}$.   **196.** $381\frac{13}{185}$.
197. $760\frac{44}{105}$.   **198.** $240\frac{10}{33}$.   **199.** $185\frac{27}{88}$.   **200.** .625.   **201.** .6.
202. $.66\frac{2}{3}$.   **203.** $.41\frac{2}{3}$.   **204.** .3125.   **205.** $.83\frac{1}{3}$.   **206.** .875.
207. .44.   **208.** .15.   **209.** .5625.   **210.** .59375.   **211.** .35.
212. .4375.   **213.** .68.   **214.** $.58\frac{1}{3}$.   **215.** .6363.   **216.** .2903.
217. .6164.   **218.** .5471.   **219.** .6296.   **220.** .4736.   **221.** 1.5714.
222. 1.4705.   **223.** 1.2962.   **224.** .7551.   **225.** .5384.   **226.** .4545.
227. .0166.   **228.** .4615.   **229.** 1.5882.   **230.** .5416.   **231.** $\frac{1}{2}$.
232. $\frac{1}{4}$.   **233.** $1\frac{3}{5}$.   **234.** $\frac{1}{3}$.   **235.** $1\frac{3}{5}$.   **236.** $1\frac{3}{4}$.   **237.** $\frac{2}{5}$.   **238.** $\frac{3}{4}$.
239. $2\frac{1}{5}$.   **240.** $\frac{3}{8}$.   **241.** $\frac{7}{8}$.   **242.** $\frac{5}{8}$.   **243.** $\frac{1}{10}$.   **244.** $\frac{7}{20}$.   **245.** $4\frac{3}{10}$.
246. $\frac{3}{4}$.   **247.** $\frac{3}{20}$.   **248.** $\frac{1}{8}$.   **249.** $\frac{11}{20}$.   **250.** $\frac{1}{15}$.   **251.** $1\frac{7}{25}$.   **252.** $1\frac{1}{5}$.
253. $\frac{8}{25}$.   **254.** $\frac{29}{50}$.   **255.** $1\frac{3}{5}$.   **256.** $\frac{23}{25}$.   **257.** $\frac{9}{15}$.   **258.** $\frac{9}{20}$.
259. $\frac{19}{50}$.   **260.** $\frac{27}{50}$.   **261.** $1\frac{3}{20}$.   **262.** $\frac{17}{20}$.   **263.** $\frac{24}{25}$.   **264.** $\frac{6}{25}$.
265. $\frac{17}{25}$.   **266.** $\frac{31}{40}$.

Page 223. — **1.** \$.10.   **2.** \$.44.   **3.** \$.46.   **4.** $\$.04\frac{1}{2}$.   **5.** \$.21.

Page 224. — **6.** \$.06.   **7.** \$.19.   **8.** \$.04.   **9.** \$.72.

Page 225. — **1.** \$.09.   **2.** \$.08.   **3.** \$.15.   **4.** \$.52.   **5.** \$.08.
6. \$.16.   **7.** \$.70.   **8.** \$.10.   **9.** \$.10.   **10.** \$.25.   **11.** \$.07.
12. \$.24.   **13.** \$.45.   **14.** \$.70.   **15.** \$.39.   **16.** \$.13.   **17.** \$.28.
18. \$1.10.   **19.** \$.16.   **20.** \$.15.

Page 227. — **3.** $\frac{3}{4}$.   **4.** $\frac{1}{2}$.   **5.** $\frac{1}{4}$.   **6.** $\frac{5}{8}$.   **7.** $\frac{4}{5}$.   **8.** $\frac{1}{3}$.   **9.** $\frac{1}{2}$.
10. $\frac{1}{3}$.   **11.** $\frac{1}{3}$.   **12.** 25 ¢ ; $\frac{1}{4}$.   **13.** $\frac{1}{2}$.   **14.** $\frac{1}{2}$.   **15.** $\frac{3}{4}$; $1\frac{1}{2}$.   **16.** $\frac{5}{6}$.
17. $\frac{1}{4}$.

Page 228. — **18.** $\frac{1}{3}$.   **19.** $\frac{1}{2}$ yd.   **21.** Mary, 28 qt. ; Lucy, 21 qt.

Page 229. — **4.** 96.   **5.** 539.   **6.** $4\frac{1}{2}$.   **7.** $13\frac{1}{3}$.   **8.** $1\frac{7}{8}$.   **9.** $1\frac{7}{14}$.
10. $1\frac{1}{14}$.   **11.** 7.   **12.** 4.   **13.** \$1500.   **14.** \$200.   **15.** 80 words.
16. \$2000.   **17.** \$1650.

Page 231. — **43.** $\$937\frac{1}{2}$.   **44.** \$6.   **45.** $\$3.12\frac{1}{2}$.   **46.** \$3.75 ; \$1.25.
1. 41.   **2.** 77.   **3.** 37.   **4.** 39.   **5.** 84.   **6.** 2.   **7.** 8.   **8.** 96.
9. 4.   **10.** 6.   **11.** 7.   **12.** 7.   **13.** 4.   **14.** 2.

Page 234. — **1.** \$3.25.   **2.** 100 gal.   **3.** \$56,749.25.   **4.** \$57,679.82.
6. $\$166.66\frac{2}{3}$.   **7.** \$5.28.   **8.** \$9.75.   **9.** $6\frac{1}{4}$ da.   **10.** 68 mi.

Page 235. — **12.** 55 ¢ ; 670 heat units.   **13.** 30 ¢ ; 695 heat units.
14. 25 ¢ less ; 25 more heat units.   **15.** 45 ¢ ; 765 heat units.   **16.** 40 ¢ ;
860 heat units ; meal cost 5 ¢ less and provided 95 heat units more than the
meal in Ex. 15.   **17.** \$63.58.   **18.** \$1600.   **19.** \$758.81 ; \$491.23 ;
\$228.12 ; \$314.97.

Page 236. — **1.** $50\frac{5}{8}$ ¢.   **2.** $54\frac{1}{4}$ ¢.   **3.** $58\frac{1}{4}$ ¢.   **4.** $73\frac{3}{4}$ ¢.   **5.** $81\frac{1}{8}$ ¢.
6. $89\frac{1}{4}$ ¢.   **7.** $7\frac{1}{2}$ yd.   **8.** $1\frac{1}{4}$ yd.   **9.** 16 dresses ; 11 dresses.   **10.** 16
dresses.   **11.** 15 yd.   **12.** \$.80.   **13.** $56\frac{1}{4}$ ¢.   **14.** \$24.30.

Page 237. — **1.** $\frac{5}{8}$ lb.   **2.** $\$1\frac{7}{8}$ or \$1.88.   **3.** 24 rows.   **4.** $11\frac{1}{2}$ hr.
5. $5\frac{1}{4}$ hr.   **6.** $5\frac{3}{4}$ hr.   **7.** $2\frac{13}{15}$ hanks.   **8.** \$1.69.   **9.** $2\frac{1}{5}$ hr.   **10.** $1\frac{9}{16}$
hr.   **11.** \$4.   **12.** 8 pairs.

Page 238. — 24. .5 ; 50 %. **25.** .25 ; 25 %. **26.** .75 ; 75 %. **27.** .2 ; 20 %. **28.** .4 ; 40 %. **29.** .6 ; 60 %. **30.** .8 ; 80 %. **31.** .1 ; 10 %. **32.** .15 ; 15 %. **33.** .16 ; 16 %. **34.** .12 ; 12 %. **35.** .28 ; 28 %.

Page 239. — 36. .01 ; 1 %. **37.** 2 % ; 4 % ; 12 % ; 10 % ; 6 % ; 66 %.

Page 243. — 2. $1200. **3.** $880. **4.** 170 words. **5.** $375. **6.** $400. **7.** $10. **8.** 1440 inhabitants. **9.** 450 mi. **10.** 400 apple trees. **11.** 6 oz. **12.** 6 in.

Page 244. — 1. 34.25. **2.** 30.3. **3.** 37.5. **4.** 21.9. **5.** $54.55. **6.** $79.08. **7.** $33.28. **8.** $84.09. **9.** 38.4. **10.** 52.35. **11.** 131.1. **12.** 31.05. **13.** $100.10. **14.** $81.38. **15.** $75.08. **16.** $41.80. **17.** 5000. **18.** 4390.625. **19.** 3276.875. **20.** 1880.625. **21.** $40. **22.** $20.20. **23.** $40.12. **24.** $60.16. **25.** $5.39. **26.** $6.75. **27.** $13.41. **28.** $12.03. **29.** 5320. **30.** 2048.375. **31.** 7938. **32.** 7231. **33.** 10,208.5. **34.** 16,738.54. **35.** 4211.58. **36.** 22,100. **37.** 16,909.32. **38.** 21,385.76. **39.** 48,140.58. **40.** 12,329.64. **41.** $99,510. **42.** $106,203. **43.** $135,655.50. **44.** $108,849. **45.** $419.99. **46.** $1169.49. **47.** $1484.70. **48.** $496.25. **49.** 57,580.16. **50.** 71,192.88. **51.** 63,524.56. **52.** 29,920. **53.** 32,837.49. **54.** 47,129.67. **55.** 40,244.4. **56.** 47,388.6. **57.** 56,782.4. **58.** 80,960. **59.** 69,368. **60.** 35,880. **61.** 23,531.76. **62.** 134,113.98. **63.** 114,667.35. **64.** 94,127.04.

Page 246. — 2. 33⅓ %. **3.** 70 %. **4.** 83⅓ %. **5.** 66⅔ %. **6.** 40 %. **7.** 62½ %. **8.** 20 %. **9.** 66⅔ %. **10.** 66⅔ %. **11.** 40 %. **12.** 60 %. **13.** 14²⁄₇ %. **14.** 11⅑ %. **15.** 30 %. **16.** 40 %. **17.** 40 %. **18.** 33⅓ %. **19.** 25 %. **20.** 20 %. **21.** 57⅐ %. **22.** $2 ; 25 %. **23.** 37½ %. **24.** 75 %. **25.** 80 %.

Page 247. — 2. $45, profit. **4.** $1600, profit ; $400, loss.

Page 248. — 5. $2300, profit. **6.** $3000, loss. **7.** $140, profit. **8.** $160, loss. **11.** $125, loss ; $375, selling price. **12.** $3600, increase ; $15,600, selling price. **13.** $5, profit ; $105, selling price. **14.** $50, profit ; $300, selling price. **15.** $100, profit ; $400, selling price. **16.** $160, profit ; $800, selling price. **17.** $70, profit ; $770, selling price. **18.** $238.40, profit ; $834.40, selling price. **19.** $25.35, loss ; $819.65, selling price. **20.** $21.70, loss ; $412.30, selling price. **21.** $52, loss ; $468, selling price. **22.** $6.30, loss ; $308.70, selling price. **23.** $82, loss ; $574, selling price. **24.** $30.72, loss ; $737.28, selling price.

Page 249. — 26. 12½ %. **27.** 25 %. **28.** 33⅓ %. **29.** 20 % profit. **30.** 25 % loss. **31.** 30 % profit. **32.** 33⅓ % loss. **33.** 63 % profit. **34.** 25 % loss. **35.** 50 % profit. **36.** 10 % loss. **37.** 12½ % profit. **38.** 37½ % profit. **39.** 25 % profit. **40.** 40 % profit. **41.** 25 % profit. **42.** 12½ % loss. **43.** 60 % profit. **44.** 40 % loss. **45.** 33⅓ % profit. **46.** 33⅓ % loss. **47.** 20 % loss. **48.** 50 % profit.

Page 250. — 1. $15. **2.** $7. **3.** $2. **4.** $3. **5.** $1.50. **6.** $.50. **7.** $10.50. **8.** $25. **9.** $.50. **10.** $1.50. **11.** $28. **12.** $30. **13.** $9. **14.** $18. **15.** $50. **16.** $10.

Page 251. — **2.** $3.80.   **3.** $15.   **4.** $16.   **5.** $400.   **6.** $1050.
7. $42.   **8.** $390.   **9.** $21.25.   **10.** $60.

Page 252. — **12.** 33⅓ %.   **13.** 20 %.   **14.** 30 %.   **15.** 33⅓ %.   **16.** 50 %.
17. 25 %.   **18.** 16⅔ %.   **19.** 20 %.   **20.** 40 %.   **21.** 25 %.   **22.** 28 %.
23. 12½ %.   **24.** 7·³⁄₁₃ %.   **25.** 20 %.   **26.** 30 %.   **27.** 20 %.   **28.** 20 %.
29. 40 %.   **30.** 30 %.   **31.** 33⅓ %.   **32.** 33⅓ %.   **33.** 33⅓ %.   **34.** 12½ %.
35. 33⅓ %.

Page 254. — **1.** $168.07.   **2.** $12,532.40.   **3.** $73.33.   **4.** $339.57.
5. $75.   **6.** $190.   **7.** $400.   **8.** $294.   **9.** $700.   **10.** $4850.
11. $2100.

Page 255. — **2.** $5.   **3.** $150.   **4.** $750.   **5.** $18.01.   **6.** $5500.
8. $4800.   **9.** $2328.

Page 256. — **10.** $20.01.   **11.** $21.28.   **12.** $65.42.   **13.** $31.30.
14. $49.71.   **15.** $78.53.   **16.** $40.34.   **17.** $69.87.   **18.** $45.12.
19. $47.04.   **20.** $87.58.   **21.** $80.10.   **22.** $60.08.   **23.** $347.60.
24. $18.25.   **25.** $34.86.   **26.** $78.28.   **27.** $91.80.   **28.** $255.
29. $175.50.   **30.** $168.60.   **31.** $799.20.   **32.** $408.   **33.** $678.
34. $1086.   **35.** $3250.   **36.** $4000.   **37.** $1800.   **38.** $2700.   **39.** $3600.
40. $4500.   **41.** $5600.   **42.** $4560.   **43.** $6480.   **44.** $8064.
45. $9024.   **46.** $5092.50.   **47.** $4684.40.   **48.** $5648.80.   **49.** $918.65.
50. $148.95.   **51.** $345.74.   **52.** $482.89.   **53.** $207.74.   **54.** $526.20.
55. $570.50.   **56.** $474.08.   **57.** $603.15.   **58.** $194.68.   **59.** $489.83.
60. $630.29.   **61.** $820.08.

Page 258. — **9.** $50.   **10.** $100.   **11.** $39.   **12.** $117.   **13.** $10.
14. $18.   **15.** $24.   **16.** $21.   **17.** $18.   **18.** $30.   **19.** $20.
20. $96.   **21.** $10.   **22.** $11.25.   **23.** $27.   **24.** $10.20.   **25.** $47.
26. $16.96.   **27.** $77.50.   **28.** $170.40.   **29.** $24.   **30.** $60.
31. $144.   **32.** $30.   **33.** $40.   **34.** $48.   **35.** $108.   **36.** $70.
37. $42.   **38.** $48.   **39.** $30.60.   **40.** $92.   **41.** $85.50.   **42.** $201.60.
43. $75.   **44.** $103.20.

Page 259. — **2.** $24.   **3.** $70.   **4.** $132.   **5.** $21.60.   **6.** $67.50.
7. $48.75.   **8.** $65.10.   **9.** $88.   **10.** $24.   **11.** $26.25.

Page 260. — **12.** $52.50 ; $752.50.   **13.** $112 ; $912.   **14.** $45 ;
$945.   **15.** $67.50 ; $517.50.   **16.** $42 ; $642.   **17.** $80 ; $580.
18. $37.80 ; $577.80.   **19.** $85.75 ; $435.75.   **20.** $48.45 ; $333.45.
21. $117.80 ; $737.80.   **22.** $36.25 ; $761.25.   **23.** $80 ; $880.
24. $82.88 ; $1057.88.   **25.** $48.75 ; $698.75.   **26.** $108.50 ; $883.50.
27. $4.   **28.** $12.   **29.** $47.25.   **30.** $30.   **31.** $3.   **32.** $4.50.
33. $345.   **34.** $67.50.   **35.** $322.50.   **36.** $648.

Page 261. — **1.** 12½ pt.   **2.** 6 pies.   **3.** $12.   **4.** $1.80.   **5.** 16
baskets.   **6.** 64⅓ ⊄.   **7.** $8.96.

Page 262. — **8.** $.48 ; $3.75 ; $.68 ; $1.60 ; $.57 ; $.23 ; $.24 ; total,
$7.55.   **9.** $.10.   **10.** 9⁵⁄₂₄ lb.   **11.** 121 yd.   **12.** $180.   **13.** $2.16.
14. $10.85.

Page 263. — **15.** $90.   **16.** 208 cans.   **17.** $16.80.   **18.** $8.51.
19. $5.10.   **20.** $.93.   **21.** $2.94.   **22.** 3⅓ gal.   **23.** $.75.   **24.** $340 ;
$221.   **25.** $1.10.

Page 264. — 1. 520,408$\frac{8}{15}$ bbl.   **2.** 1 oz.   **3.** 10$\frac{1}{2}$ lb.; $\frac{8}{14}$ lb.   **4.** 2$\frac{1}{4}$ tablespoonfuls.   **5.** $\frac{1}{6}$.   **6.** 9 T.; $\frac{9}{20}$ T; 3.82\frac{1}{2}$ or $3.83.   **7.** 3$\frac{1}{2}$ lb.
8. 425 T.

Page 265. — 1. Total, $16.38 ; change, $3.62. **2.** Total, $11.03 ; change, $.47.   **3.** Total, $3.09 ; change, $1.91.   **4.** Total, $3.91 ; change, $1.09.

Page 266. — 1. $6.   **2.** 180 hr.   **3.** $48.   **4.** $20.58.   **5.** $11.34.
6. $50.   **7.** $100.   **8.** $125.   **9.** $120 ; $240.   **10.** $8.   **11.** $45.
12. $150.   **13.** $350.   **14.** 24 words.   **15.** 560 stamps.

Page 267. — 16. $96.   **17.** $135.60.   **18.** $236.   **19.** $196.
20. $137.60.   **21.** $198.   **22.** $999.20.   **23.** $175.20.   **24.** $2600.
25. $456.   **26.** George, $120 ; Philip, $175 ; total, $295.   **27.** Alfred,
$36; Louise, $30.   **28.** $74.   **29.** $65.

Page 269. — 1. $165.54.   **2.** $25.87.   **3.** 11.1751.   **4.** $6272.12.
5. $187.64.   **6.** $102.293.   **7.** 354.3266.   **8.** $10,298.39.   **9.** $75.51.
10. $382.755.   **11.** 189.6174.   **12.** 98.419.

Page 270. — 13. 174,386.   **14.** 124,689.   **15.** 57,322.   **16.** 70,206.
17. 22,965.   **18.** $1753.73.   **19.** $1.266.   **20.** .5675.   **21.** 19.724.
22. 113.8909.   **23.** .101.   **24.** 142,378.   **25.** 54,424.   **26.** 107,633.   **27.** 62,675.
28. 83,108.   **29.** $3178.23.   **30.** $2.24.   **31.** .0466.   **32.** 33.58.   **33.** .101.
34. 4.3935.   **35.** $38.45.   **36.** $1124.38.   **37.** 1711.666.   **38.** 547.185.
39. 13.452.   **40.** $539.61.   **41.** $20.77.   **42.** 2.4194.   **43.** 38.068.
44. 100.192.   **45.** 8.2415.

Page 271. — 46. $80,000.   **47.** $105,000.   **48.** $3600.   **49.** $7474.50.
50. $50,050.   **51.** $300.   **52.** $20.   **53.** $1600.   **54.** $7552.50.
55. $31,248.   **56.** $229.74.   **57.** $777.70.   **58.** $104.   **59.** $111.10.
60. $800.   **61.** 7500.   **62.** 150.   **63.** 1500.   **64.** 900.   **65.** 110.
66. $1100.   **67.** $654.15.   **68.** 90,250.   **69.** 930.   **70.** 48.3072.
71. 436.37448.   **72.** .00427.   **73.** 239.9232.   **74.** 289, r. 12.   **75.** 611,
r. 231.   **76.** $1.71.   **77.** 4000.   **78.** $.04.   **79.** 240,000.   **80.** 200.
81. 2000.   **82.** 2000.   **83** 20.   **84.** 20.   **85.** .2.   **86.** 30.   **87.** 3000.
88. 605, r. 310.   **89.** $2.28.   **90.** $.59.   **91.** .3.   **92.** 300.   **93.** 30,000.
94. .06.   **95.** .3.   **96.** 3000.   **97.** .003.   **98.** 3.   **99.** .03.
100. .00003.   **101.** 3000.

Page 272. — 102. 8 yd. 11 in.   **103.** 46 min. 3 sec.   **104.** 3 pk.
7 qt.   **105.** 15 lb. 11 oz.   **106.** 5 mi. 300 rd.   **107.** 13 yr. 9 mo.
108. 1 ft. 11 in.   **109.** 6 mi. 315 rd.   **110.** 2 yd. 2 ft.   **111.** 2 wk. 6 da.
112. 1 doz. 7.   **113.** 3 lb. 14 oz.   **114.** .75.   **115.** .875.   **116.** .66$\frac{2}{3}$.
117. .3125.   **118.** .15.   **119.** .88$\frac{8}{9}$.   **120.** .16.   **121.** .8.   **122.** .85$\frac{5}{7}$.
123. .44$\frac{4}{9}$.   **124.** .90$\frac{10}{11}$.   **125.** .41$\frac{2}{3}$.   **126.** .1875.   **127.** .4375.
128. .35.   **129.** .466$\overline{6}$.   **130.** .4545.   **131.** .9545.   **132.** .8421.
133. .1388.   **134.** .8666.   **135.** .2343.   **136.** .4583.   **137.** .3846.
138. .3684.   **139.** .7222.   **140.** .1166.   **141.** .7857.   **142.** .7333.
143. .5333.   **144.** $\frac{3}{5}$.   **145.** $\frac{5}{12}$.   **146.** $\frac{2}{5}$.   **147.** $\frac{29}{120}$.   **148.** $\frac{5}{8}$.
149. $\frac{7}{15}$.   **150.** $\frac{7}{24}$.   **151.** $\frac{7}{12}$.   **152.** $\frac{5}{8}$.   **153.** $\frac{1}{4}$.   **154.** $\frac{5}{18}$.   **155.** $\frac{7}{10}$.
156. $\frac{1}{4}$.   **157.** $\frac{1}{7}$.   **158.** $\frac{7}{12}$.   **159.** $\frac{1}{7}$.

Page 273.—160. $1\frac{7}{8}$. **161.** $1\frac{5}{6}$. **162.** $4\frac{9}{16}$. **163.** $2\frac{3}{8}$. **164.** $4\frac{9}{16}$.
165. $2\frac{5}{6}$. **166.** $\frac{7}{76}$. **167.** $11\frac{1}{3}$. **168.** $\frac{1}{3}$. **169.** $\frac{4}{5}$. **170.** $\frac{3}{4}$. **171.** $\frac{3}{8}$.
172. $\frac{9}{13}$. **173.** $\frac{7}{8}$. **174.** $\frac{5}{6}$. **175.** $\frac{7}{8}$. **176.** 8. **177.** 18. **178.** 4.
179. 10. **180.** 42. **181.** 16. **182.** 60 yd. **183.** 20 yd. **184.** 8 yd.
185. 384 yd. **186.** 198 yd. **187.** 32 yd. **188.** $11\frac{1}{4}$; $5\frac{3}{5}$. **189.** $43\frac{9}{16}$;
$6\frac{1}{8}$. **190.** $19\frac{3}{8}$; $8\frac{7}{16}$. **191.** $55\frac{5}{16}$; $16\frac{11}{12}$. **192.** $11\frac{1}{4}$; $3\frac{3}{5}$. **193.** $82\frac{5}{16}$;
$25\frac{7}{10}$. **194.** $35\frac{7}{12}$; $3\frac{1}{4}$. **195.** $74\frac{11}{12}$; $23\frac{19}{20}$. **196.** 7. **197.** 12. **198.** $\frac{9}{128}$.
199. $\frac{9}{25}$. **200.** $9\frac{1}{16}$. **201.** $24\frac{13}{20}$. **202.** 24. **203.** 20. **204.** $3\frac{1}{4}$.
205. $\frac{24}{25}$. **206.** $1\frac{8}{9}$. **207.** $1\frac{7}{15}$.

Page 274.—208. 5. **209.** 55. **210.** 300. **211.** 200. **212.** 50. **213.** 300.
214. 1800. **215.** 112.5. **216.** 302.6. **217.** 487.5. **218.** $5, gain.
219. $30, gain. **220.** $100, loss. **221.** $120, loss. **222.** 50 %, profit.
223. $12\frac{1}{2}$ %, loss. **224.** 20 %, loss. **225.** 50 %, profit. **226.** $4;
$36. **227.** $10; $70. **228.** $6; $18. **229.** $12; $228. **230.** $15.
231. $10. **232.** $360. **233.** $600. **234.** $6; $106. **235.** $16;
$216. **236.** $45; $345. **237.** $48; $448. **238.** $15; $615.
239. $68; $918. **240.** $71.25; $1021.25. **241.** $79.20; $959.20.

Page 277.—1. Checks, $252.87; deposits, $2317.25; balance, $2064.38.
2. 705,000 bbl. **3.** 70.6 mi. per hour. **4.** 122.2 mi. per hour.
5. 29.6 mi. per hour. **6.** $78\frac{13}{18}$ T. **7.** $.07; $\frac{1}{4}$ yd.

Page 278.—8. $4.05. **9.** $8\frac{5}{8}$ ft. **10.** $1\frac{7}{15}$ mi. **11.** $2\frac{1}{4}$ in.
12. 28 pads. **13.** 6 badges. **14.** $1.60. **15.** $72\frac{5}{8}$ ft. **16.** $22\frac{1}{2}$ pt.,
or $11\frac{1}{4}$ qt. **17.** $5\frac{5}{8}$ yd. **18.** $3\frac{1}{4}$ hr. **19.** 20 glasses. **20.** John, $\frac{9}{50}$;
Paul, $\frac{2}{5}$; John, $3.01; Paul, $6.69.

Page 279.—21. $3\frac{7}{8}$ lb. **22.** 210 mi. **23.** $4.33. **24.** $2.20.
25. $53\frac{1}{3}$ mi. per hour. **26.** 8 yd. $25\frac{1}{2}$ in. **27.** 9500 packages.
28. 12,300 ft. or $2\frac{33}{62}$ mi. **29.** 205 ft. **30.** 40 mi. per hour. **31.** $200.
32. $16\frac{2}{3}$ %. **33.** $33.60. **34.** $2355.

Page 280.—35. $4\frac{1}{3}$ wk.; $24 a week; $4 a month more. **36.** Food,
$600; clothing, $300; rent, $400. **37.** $10,243.20. **38.** Daisy, 8.4 lb.;
Bossy, 9.9 lb.; Lucy, 7.6 lb.; Beth, 6.18 lb. **39.** $540. **40.** $495.
41. $82.50. **42.** Food, $33\frac{1}{3}$ %; rent, 20 %; clothing, $16\frac{2}{3}$ %.
43. $1090.66; $1178.52.

Page 281.—3. $2 \times 2 \times 2 \times 2 \times 2 \times 3$. **4.** $2 \times 2 \times 5 \times 5$.
5. $2 \times 2 \times 2 \times 2 \times 3 \times 5$. **6.** $2 \times 2 \times 2 \times 3 \times 3 \times 5$.
7. $2 \times 2 \times 2 \times 3 \times 5 \times 5$. **8.** $2 \times 2 \times 3 \times 3 \times 5 \times 5$.
9. $3 \times 3 \times 3 \times 3 \times 3 \times 7$. **10.** $2 \times 3 \times 3 \times 7 \times 17$.

Page 282.—2. 36. **3.** 18. **4.** 21. **5.** 13. **6.** 9. **7.** 8. **8.** 5.
9. 10. **10.** 11. **11.** 7. **12.** 7. **13.** 16.

Page 284.—3. 48. **4.** 72. **5.** 42. **6.** 378. **7.** 96. **8.** 756.
9. 240. **10.** 240. **11.** 2520. **12.** 300. **13.** 300. **14.** 1728.
15. 2520. **16.** 810. **17.** 120. **18.** 96. **19.** 420. **20.** 420. **21.** 525.
22. 96. **23.** 150. **24.** 2100. **25.** 945. **26.** 280. **27.** 576. **28.** 2080.
29. 3600. **30.** 6600. **31.** 840. **32.** 1800. **33.** 600. **34.** 264.
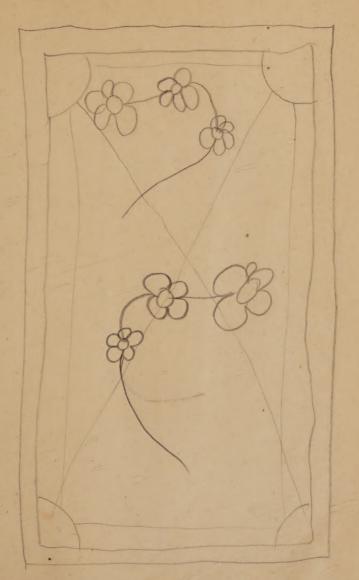
35. 810.
36. $\frac{5}{16}$, $\frac{7}{16}$, $\frac{7}{16}$.
37. $\frac{13}{45}$, $\frac{2}{45}$, $\frac{5}{45}$.
38. $\frac{15}{60}$, $\frac{12}{60}$, $\frac{18}{60}$.
39. $\frac{42}{110}$.
40. $\frac{35}{168}$, $\frac{84}{168}$, $\frac{21}{168}$.
41. $\frac{72}{504}$, $\frac{98}{504}$, $\frac{56}{504}$.
42. $\frac{45}{560}$, $\frac{40}{560}$, $\frac{86}{560}$.
43. $\frac{20}{180}$, $\frac{18}{180}$, $\frac{9}{180}$.
44. $\frac{6}{80}$, $\frac{8}{80}$, $\frac{2}{80}$.
45. $\frac{18}{24}$, $\frac{18}{24}$, $\frac{2}{24}$.
46. $\frac{18}{24}$, $\frac{20}{24}$, $\frac{12}{24}$.
47. $\frac{90}{72}$, $\frac{40}{72}$, $\frac{45}{72}$.
48. $\frac{70}{80}$, $\frac{25}{80}$, $\frac{14}{80}$.
49. $\frac{80}{90}$, $\frac{48}{90}$, $\frac{21}{90}$.
50. $\frac{90}{100}$, $\frac{5}{100}$, $\frac{2}{100}$.
51. $\frac{20}{24}$, $\frac{2}{24}$, $\frac{1}{24}$.
52. $\frac{50}{120}$, $\frac{25}{120}$, $\frac{14}{120}$.
53. $\frac{40}{150}$, $\frac{24}{150}$, $\frac{1}{150}$.
54. $\frac{18}{150}$, $\frac{4}{150}$, $\frac{3}{150}$.
55. $\frac{18}{120}$, $\frac{12}{120}$, $\frac{9}{120}$.
56. $\frac{14}{100}$, $\frac{80}{100}$, $\frac{3}{100}$.
57. $\frac{12}{24}$, $\frac{6}{24}$, $\frac{3}{24}$.
58. $\frac{4}{12}$, $\frac{7}{12}$, $\frac{5}{72}$.
59. $\frac{32}{80}$, $\frac{2}{80}$, $\frac{1}{80}$.
60. $\frac{12}{84}$, $\frac{9}{84}$, $\frac{10}{84}$.
61. $\frac{12}{24}$, $\frac{6}{24}$, $\frac{3}{24}$.
62. $\frac{20}{100}$, $\frac{8}{100}$, $\frac{7}{100}$.

TABLES FOR REFERENCE

Liquid Measures

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)
31½ gallons	= 1 barrel (bbl.)

Dry Measures

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)

The standard unit of liquid measure is the gallon.

1 gal. = 231 cu. in.; 1 cu. ft. = about 7½ gal. 1 gal. of water weighs about 8⅓ lb.; 1 cu. ft. of water weighs about 62½ lb., or 1000 oz.

The standard unit of dry measure is the bushel.

1 bu. (*stricken*, even full) = 2150.42 cu. in., or about 1¼ cu. ft.

Measures of Length

12 inches (in.)	= 1 foot (ft.)
3 feet	= 1 yard (yd.)
5½ yards 16½ feet	} = 1 rod (rd.)
320 rods 5280 feet	} = 1 mile (mi.)

Measures of Surface

144 square (sq.) inches	= 1 square foot
9 square feet	= 1 square yard
30¼ square yards	= 1 square rod
160 square rods 43,560 square feet	} = 1 acre (A)
640 acres	= 1 square mile

The standard unit of length is the yard.

The acre is not a square unit like the square foot, the square yard, etc. When in the form of a square, it is nearly 209 ft. on a side.

Measures of Volume

1728 cubic (cu.) inches =	1 cubic foot
27 cubic feet =	1 cubic yard

A **

Stationers' Table

24 sheets	= 1 quire
20 quires	= 1 ream

TABLES FOR REFERENCE

Avoirdupois Weight

16 ounces (oz.) = 1 pound (lb.)	*60 pounds = 1 bu. of wheat
100 pounds = 1 hundred-	*60 pounds = 1 bu. of Irish potatoes
weight (cwt.)	*55 pounds = 1 bu. of sweet potatoes
2000 pounds = 1 ton (T.)	*56 pounds = 1 bu. of shelled corn
20 hundredweight = 1 ton	or of rye
2240 pounds = 1 *long* ton	*70 pounds = 1 bu. of corn in ear
	*32 pounds = 1 bu. of oats
	*48 pounds = 1 bu. of buckwheat
	or of barley
	196 pounds = 1 bbl. of flour
	200 pounds = 1 bbl. beef or pork
	* In most states.

The standard unit is the pound, which = 7000 grains (gr.). 1 av. oz. = 437½ gr.

The long ton is used in the United States customhouses and in wholesale transactions in coal and iron. The long cwt. = 112 lb.

Measures of Time

60 seconds (sec.) = 1 minute (min.)	
60 minutes = 1 hour (hr.)	
24 hours = 1 day (da.)	Thirty days have September,
7 days = 1 week (wk.)	April, June, and November.
12 months (mo.) } = 1 common year (yr.)	All the rest have thirty-one
	Save February, which alone
365 days	Has twenty-eight, and one day
366 days = 1 leap year	more
10 years = 1 decade	We add to it one year in four.
100 years = 1 century	

A solar year = 365 da. 5 hr. 48 min. 46 sec., or nearly 365¼ da. The standard unit of time is the day, which is divided into 24 hr., counting from midnight to midnight. In business transactions 30 da. are usually considered as 1 mo. and 360 da. as 1 yr.

The centennial years divisible by 400, and all other years divisible by 4, are leap years.

United States Money

10 mills = 1 cent (¢)	
10 cents = 1 dime	
10 dimes } = 1 dollar ($)	
100 cents	

Counting

12 things = 1 dozen (doz.)
12 dozen = 1 gross (gro.)
12 gross = 1 great gross
20 things = 1 score

B **